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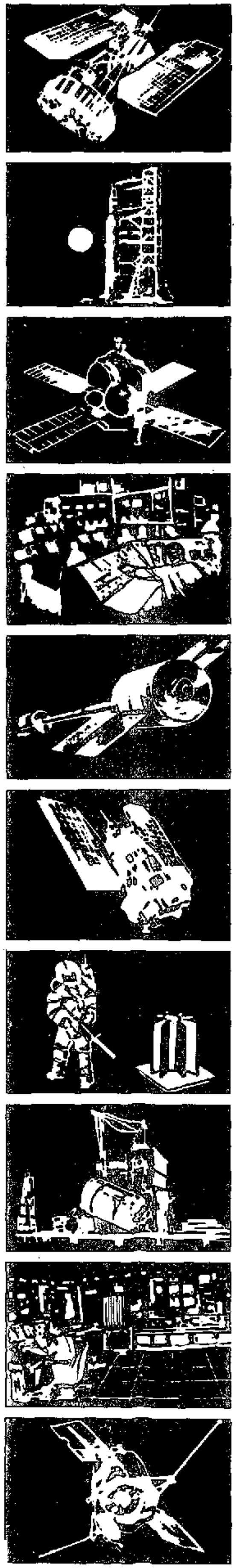

73SD4249
29 MAY 1973

ERTS 1 FLIGHT EVALUATION REPORT
23 JANUARY 1973 TO 23 APRIL 1973

Prepared By
GE ERTS OPERATIONS CONTROL CENTER

For

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Goddard Space Flight Center
Greenbelt, Maryland 20771

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GENERAL ELECTRIC

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APPROVED: Thomas W. Winchester
Thomas W. Winchester

SPACE DIVISION
Valley Forge Space Center
P. O. Box 8555 • Philadelphia, Penna. 19101

GENERAL ELECTRIC

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

INTRODUCTION

This is the fourth in a series of documents issued periodically to present flight performance analysis of the ERTS-1 Spacecraft. Previously issued documents are:

Doc. ID	Title	Date
72SD4255	ERTS-1 Launch and Flight Activation Evaluation Report	18 October 1972
72SD4262	ERTS-1 Flight Evaluation Report 23 July to 23 October 1972	28 November 1972
72SD4224	ERTS-1 Flight Evaluation Report 23 October to 23 January 1973	27 February 1973

This report contains analyses of performance for the third three months of operation, i.e., Orbit 2600 to 3810.

Documents, reports and listings related to this report are contained in the following Appendixes:

Appendix	Contents
A	Evaluation Related Documents Issued During this Reporting Period
B	A List of all Anomalies Observed Since Launch
C	ERTS-1 DCS Platform Lists
D	ERTS-1 Flight Hardware Operating Time Summary of Prelaunch Testing
E	ERTS-1 Attitude and Rate Histograms
F	ERTS-1 Ground Trace Repeat Cycle Prediction Table (Contains Spacecraft Orbit/Day Relationship)

Future ERTS-1 reports are scheduled on a quarterly basis.

SECTION 1

SUMMARY

SECTION 1

SUMMARY - ORBITS 2600 - 3810

The ERTS-1 spacecraft was launched from the Western Test Range on 23 July 1972 at 18:06:06.508Z. The launch and orbital injection phase of the space flight were nominal and deployment of the spacecraft followed predictions. Orbital operations of the spacecraft and payload subsystems were satisfactory through Orbit 147 after which a power transient disabled one of the Wideband Video Tape Recorders. Operations resumed until Orbit 196 when the Return Beam Vidicon failed to respond when commanded off. The RBV was commanded off via alternate commands and since that time ERTS-1 has performed its mission with the Multispectral Scanner and the remaining Wideband Video Tape Recorder providing image data. In Orbit 3463 abnormally high minor frame sync error counts were seen on the WBVTR-1 data, but operations continue on restricted sections of the tape and the error counts have greatly diminished.

ORBITAL PARAMETERS

The launch and injection of ERTS-1 required some correction at Orbit 44 and 59 to achieve the desired 18-day repeat cycle. During Orbit 938 it was necessary to execute a 12.8 second burn and in Orbit 2416 a 20.4 second burn of the -X thruster to maintain the ground trace in the desired 18-day repeat pattern of ± 10 miles.

POWER SUBSYSTEM

The power subsystem performed well throughout this report period. Solar array current has been slightly higher than prediction. Data from this period shows the array degradation to be slightly lower than projected. The power subsystem will meet ERTS-1 power requirements through fall of 1974. Battery temperature spread decreased as expected and performance of each battery remained good.

ATTITUDE CONTROL SUBSYSTEM

From the initial acquisition, the ACS performance has been excellent. All functions are active and well within specifications. Perturbations due to sun glint in the IR horizon scanners are not disruptive enough to necessitate single scanner mode. The magnetic moment

compensating assembly corrected the + Roll gating to permit flywheel unloading during darkness when payloads are disabled. Gating frequency decreased during this period and only 13 percent of the impulse available at launch has been used. The ACS responded well to orbit adjust maneuvers.

COMMAND/CLOCK SUBSYSTEM

All stored commands have executed and all real time commands except the expected one in approximately 10,000 associated with the logic race in the design. No serious problems have resulted from these few commands failing to execute. A minor anomaly has occurred in loading COMSTOR B; cell 12 which on twenty-three occasions verified with a delta of 256 seconds change to the desired execute time. Each time, a second try verified correctly. No explanation has yet been found for this condition.

TELEMETRY SUBSYSTEM

The telemetry subsystem has consistently performed in an excellent manner. Memory Section 0, 0 has been in use since launch and no alternates have been required. All dropouts have been associated with known link or ground problems.

ORBIT ADJUST SUBSYSTEM

The orbit adjustment subsystem has been fired five times, all from the -X thruster. The four second burn gave 60 percent of computed thrust but longer burns gave very near computed thrust. Three firings were for initial correction, two for orbit maintenance.

MAGNETIC MOMENT COMPENSATING ASSEMBLY

The Magnetic Moment Compensating Assembly has been operated six times and performance has been reasonably close to nominal. The hysteresis loop associated with the MMCA requires trial and error after the first charge and dump. The attained performance of the unit is considered excellent. It has held the Pole-Cm values commanded in earlier orbits.

UNIFIED 'S' BAND/PRE-MODULATOR PROCESSOR

The Unified 'S' Band Receiver, Transmitter, and Premodulation Processor have continued to operate satisfactorily, even though the power output of the 'A' transmitter has dropped to 0.29 watts from its launch value of 1.6 watts, the system still exceeds the link margin requirements. No adverse effects have been observed on its performance of telemetry reporting, ranging and relay of DCS messages.

ELECTRICAL INTERFACE SUBSYSTEM

The Auxiliary Processing Unit (APU), Interface Switching Module (ISM) and Power Switching Module (PSM) performed normally in this report period. The RBV switching relay (within the PSM) failed on Orbit 196 and has not been in use.

THERMAL CONTROL SUBSYSTEM

The thermal subsystem performed normally throughout this report period. Temperatures decreased slightly due to decreasing sun intensity but had no noticeable effect on operation.

NARROW BAND TAPE RECORDERS

The Narrow Band Tape Recorder Subsystem has continued to operate satisfactorily. Each recorder in turn has operated through its modes of record, standby, playback and off for a total ON time of 3342 hours.

WIDE BAND TELEMETRY SUBSYSTEM

The Wide Band Telemetry Subsystem has continued to operate satisfactorily. Wide Band Power Amplifier No. 2 has been the primary instrument used to transmit MSS to ground stations. AGC readings with the spacecraft overhead customarily reads about -76 dBm; at 2600 kilometers slant range the AGC readings are about -82 dBm.

ATTITUDE MEASUREMENT SENSOR

The AMS continues to function in all respects. Derived values are being used in image processing and effort is continuing to improve correlation relationship between spacecraft attitude, the ACS and the AMS.

WIDE BAND VIDEO TAPE RECORDERS

Wide Band Video Tape Recorder No. 1 operated satisfactorily for 552 hours and 53 minutes head contact time (including 126 hours of pre-launch testing) until Orbit 3463 when high MFSE counts were noted. Since then, the recorder has been operated on selected short portions of the tape with satisfactorily reduced MFSE counts. Wide Band Video Tape Recorder No. 2 failed in Orbit 148. MSS video reproduction, MSS Bit Error Rate, search track, control track and spacecraft time are all nominal.

RETURN BEAM VIDICON

The Return Beam Vidicon Subsystem has been idle since Orbit 196, when its input power supply switching system malfunctioned. The RBV had operated satisfactorily up to that point, photographing 1690 scenes of good quality. The failure was not in the RBV itself, nor was the RBV affected by the failure.

MULTISPECTRAL SCANNER SUBSYSTEM

The Multispectral Scanner Subsystem (MSS) has operated satisfactorily. Since launch, the MSS has covered an area ten times the total land mass of the earth. The steady decrease of the cal wedge level in Bands 1 and 2 experienced through the first 1200 Orbits, has leveled off.

DATA COLLECTION SYSTEM

The Data Collection Subsystem (DCS) continued to operate satisfactorily. The DCS experienced several external interference for 15 days, but returned to normal operations after each incident. The interfering source was located in Texas. Received messages have increased about 50% from the period of the prior report. Only receiver No. 1 has operated to date.

PAYLOAD OPERATION SUMMARY

Launch through Orbit 3810 (1)

Subsystem	Orbital On-Time HH:MM:SS	Operational Summary	
RBV	13:59:09	Total scenes photographed	1690
		Average scenes per day	139
		Total area photographed (square nautical miles)	14.7×10^6
		ON-OFF cycles	91
		% Real Time scenes	57
		% Recorded scenes	43
MSS	530:26:01	Total scenes photographed	52,356
		Average scenes per day	195
		Total area photographed (square nautical miles)	456×10^6
		ON-OFF cycles	4260
		% Real Time scenes	48
		% Recorded scenes	52
DCS	6549:03:25	Messages received at OCC	243,869
		Non perfect messages	25,562
		Ground platforms identified	218
		Max. Ground platforms active/orbit	95
		Users	30
		Average messages per orbit	121
WBVTR-1	547:34:55	% Record Mode	36
		% Playback Mode	43
		% Rewind Mode	20
		% Standby Mode	1
		Minor Frame Sync, Error Count:	
		Realtime	0
		Playback (to Orbit 3463)(2)	< 10
		Time Video Head - In-Contact(3)	429:35:22
		Cycles of Head - In-Contact	4324
WBVTR-2	9:26:33	% USAGE SAME AS WBVTR-1 FAILED IN ORBIT 148/9	
WPA-1	31:55:09	% Real Time Mode	49
		% Playback Mode	51
		Used in Orbits: 5 thru 196 and 1890 thru 2099	
		ON-OFF cycles	311
WPA-2	408:12:48	% Real Time Mode	53
		% Playback Mode	47
		Used in Orbits: 5 thru 1889 and 2100 thru 3810	
		ON-OFF cycles	3771

(1) Test time prior to launch contained in Appendix D. Flight Hardware Operating Time Summary.
(2) Subsequent to Orbit 3463, See Section 13 for values.
(3) Total Head-In-Contact Time (including 126 hrs pre-launch) is 555:35:22.

SECTION 2

ORBITAL PARAMETERS

SECTION 2

ORBITAL PARAMETERS

The ERTS-1 launch and injection was satisfactory and required only a minor orbit adjust to achieve nominal parameters. These adjustments were made in Orbits 38, 44 and 59. After several repeat cycles, orbit maintenance burns were made in Orbit 938 and again in Orbit 2416.

The orbital parameters are given in Table 2-1. Figure 2-1 shows the subsatellite plot and Figure 2-2 shows the longitude error as a function of time and orbit maintenance burns. Figure 2-3 is a summary of ERTS-1 orbital periods. Appendix F gives ground trace repeat cycle predictions.

Table 2-1. Brouwer Mean Orbital Parameters

	Element		25 Oct 1972	25 Jan 1973	25 April 1973
(1)	Apogee	KM	917.3	922.3	911.056
(2)	Perigee	KM	898.1	893.1	888.763
(3)	Inclination	deg	99.103	99.090	97.073
(4)	Semimajor Axis	KM	7,285.850	7,285.865	7,285.767
(5)	Eccentricity	--	0.00132	0.00200	0.00073
(6)	Anomalistic Period	min.	103.152	103.153	103.151
(7)	Nodal Period	min.	103.268	103.268	103.267
(8)	Argument of Perigee	deg	93.721	133.693	168.857
(9)	Right Ascension	deg	1.060	91.805	181.411
(10)	Mean Anomaly	deg	86.484	52.797	11.098
(11)	Daily % Overlap		14.9	14.7	14.9
(12)	18 day repeat cycle error	NM	+1.25	+2.72	-10.08

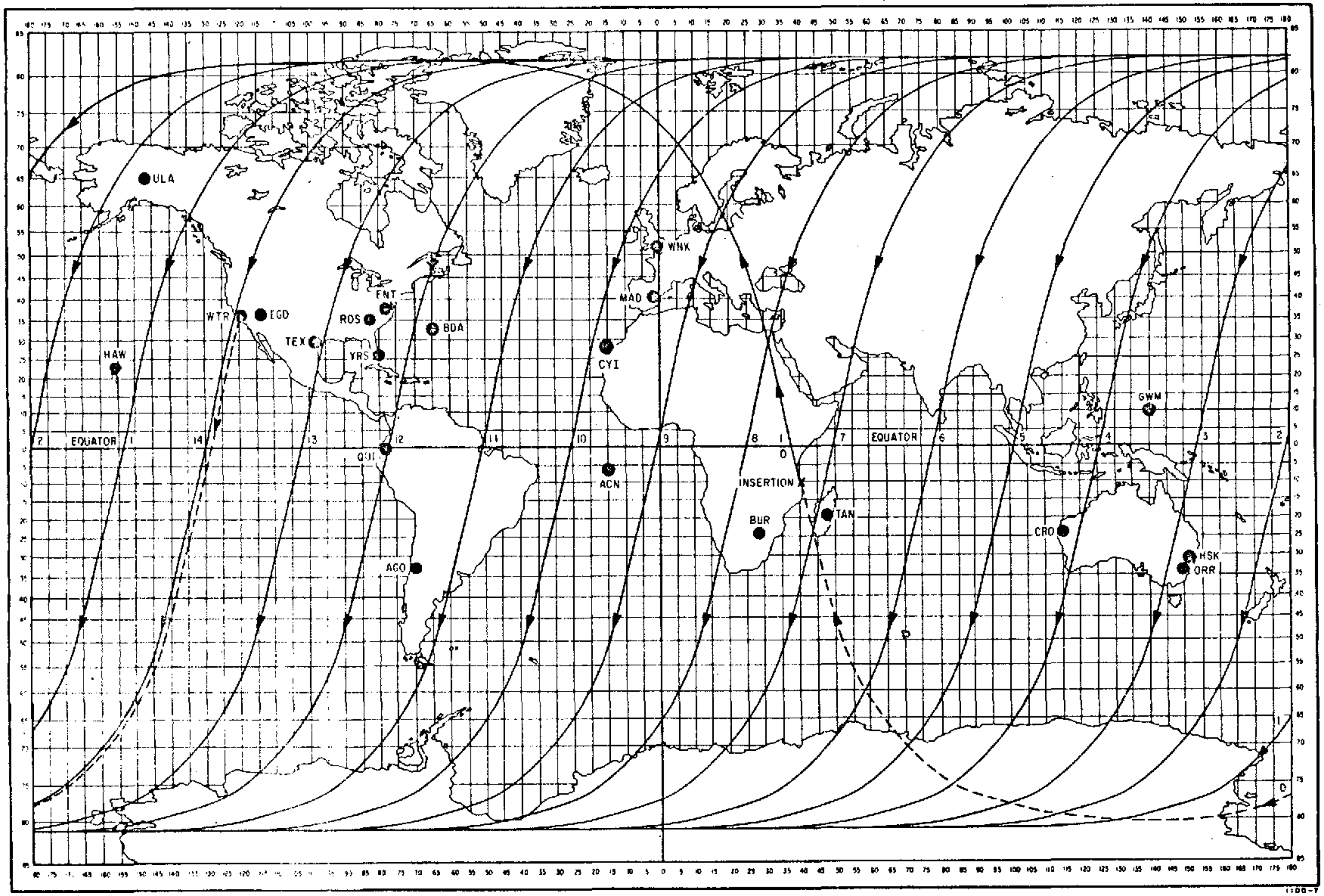

Figure 2-1. Typical Subsatellite Plot of the ERTS-1 Spacecraft

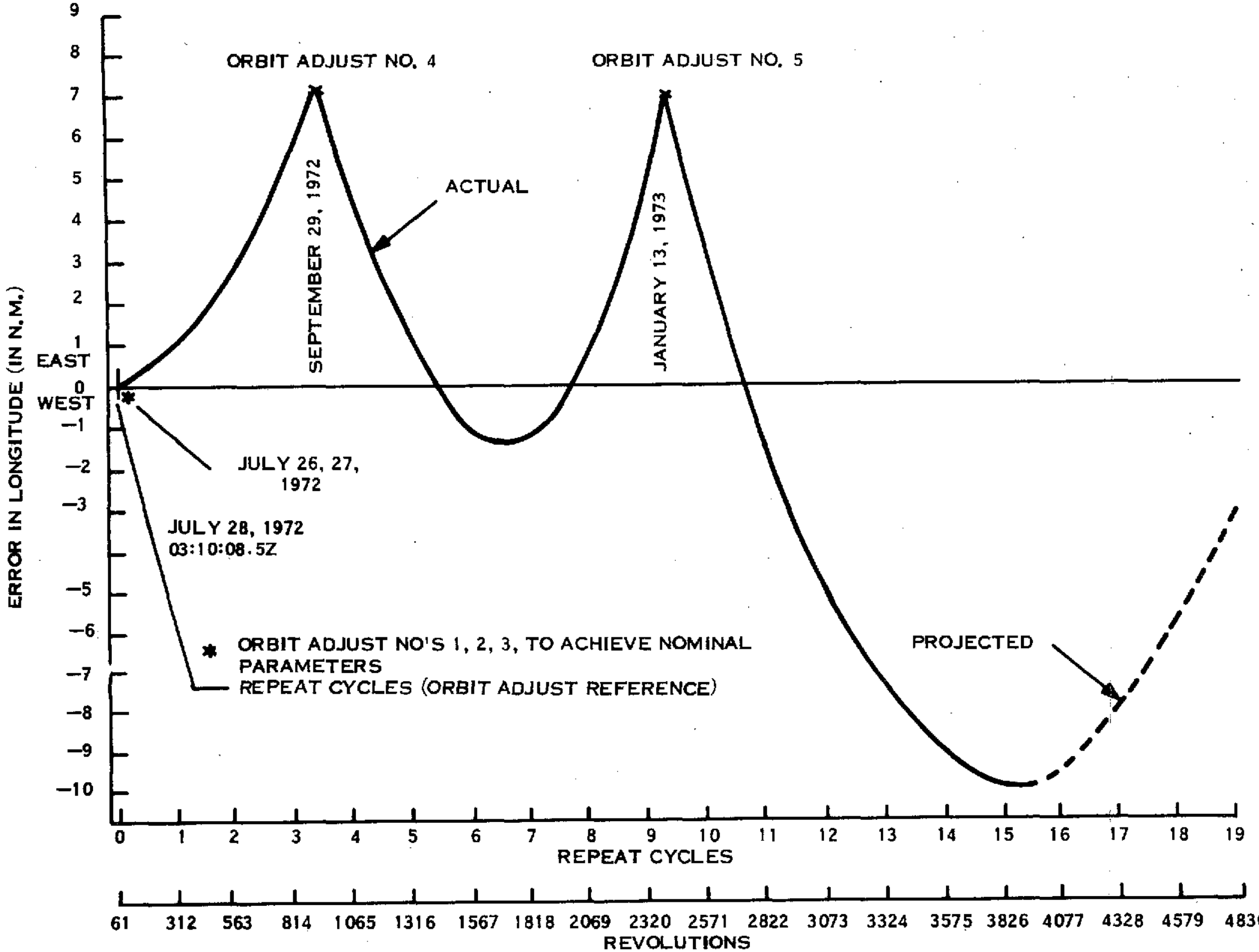

Figure 2-2. Effects of Orbit Adjust on Ground Track

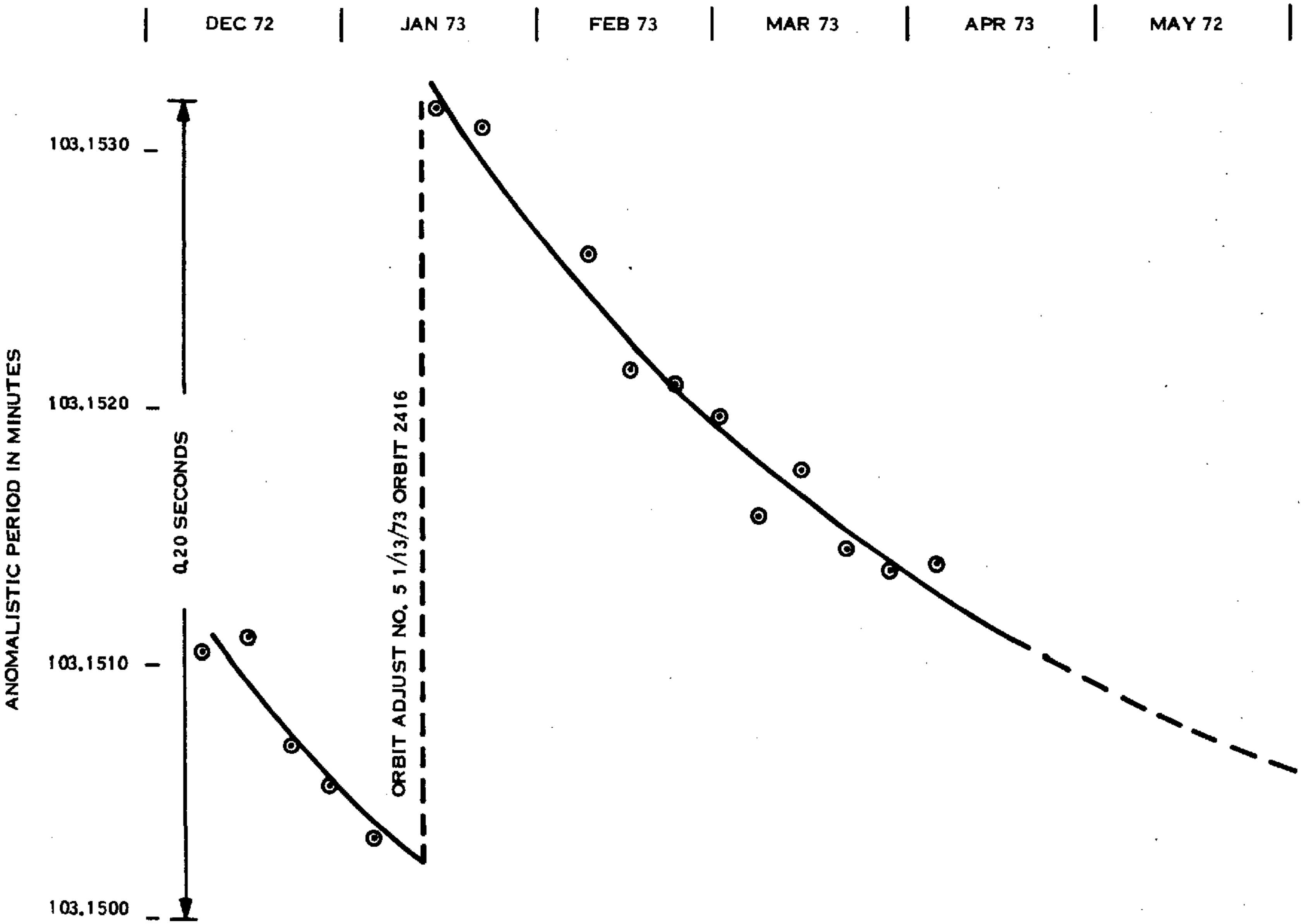

Figure 2-3. ERTS-1 Orbital Period

SECTION 3

POWER SUBSYSTEM (PWR)

SECTION 3

POWER SUBSYSTEM (PWR)

The solar array provided excess energy for the payload and spacecraft load throughout this report period. Compensation loads and auxiliary loads dissipated the excess power above the battery pack and load requirements using ERTS-1 power management procedures. Midday measured solar array current tracked slightly above the predicted value from the previous quarter indicating that the radiation degradation was less than predicted. Solar Array Degradation is revised (based on additional data from this report period) and is now predicted to be -15.3% at the end of one year. The power subsystem is predicted to meet the ERTS-1 power requirements through the fall of 1974 when reduced operation may be required because of inadequate solar array energy to supply the normal operational load and to recharge the batteries. A plot of measured and predicted solar Midday Solar Current is shown in Figure 3-1. Figure 3-2 shows actual and predicted Solar Array Current Degradation. Figure 3-3 shows Actual and Predicted Solar Paddle Sun Angles. Figure 3-4 shows Seasonal Sun Intensity Variations.

Battery packs ranged from 8.5 to 11.5 percent Depth of Discharge (DOD) with an average of 9.8 percent over a 24-hour period of normal operation. Temperature spreads between batteries decreased from 6.5°C to 4.7°C during this report period due to decreasing sun intensity and payload operations. Charge and load sharing were satisfactory. During recovery of normal operation after a station command problem, the batteries discharged to -479 ampere-minutes or 22.8 percent DOD in Orbit 3031. The battery voltages were 27.70 volts at a current of 1.0 ampere at the end of the deep discharge. Prelaunch battery tests performed on June 24, 1972 had battery voltages of 28.53 volts for 22.8 percent DOD at a current of 0.9 amperes. Battery temperatures were similar (20-25°C) in both the prelaunch test and Orbit 3031. A previously reported 22.5 percent DOD in Orbit 1819 had battery voltages of 27.53 volts at a current of 2.0 amperes for the same battery temperature. From this data and data at lighter DOD, it is predicted that the battery packs will give satisfactory operation to the end of 1974 for the present MSS and WBVTR operation. Table 3-1 shows major power subsystem parameters for typical power management

orbits (complete spacecraft night followed by a complete spacecraft day). Battery voltages and temperatures have been held to satisfactory operating limits by use of power management within this report period. A typical orbit showing solar array and battery voltages, currents, and temperatures are shown in Figures 3-5 and 3-6 for Orbit 3093.

The power system electronics performed well in this report period with all voltages stable. Table 3-2 shows power subsystem telemetry (average over telemetry period recorded on NBTR) for various orbits. Some parameters in Table 2-2 may be slightly different from Table 3-1 because Table 3-1 uses a time span for power management (night followed by day) different from the time span which is used in Table 3-2 which is the playback period from the NBTR. The Shunt Limiter has not operated since Orbit 3 because the unregulated voltage has been held below the cut-in voltage by power management.

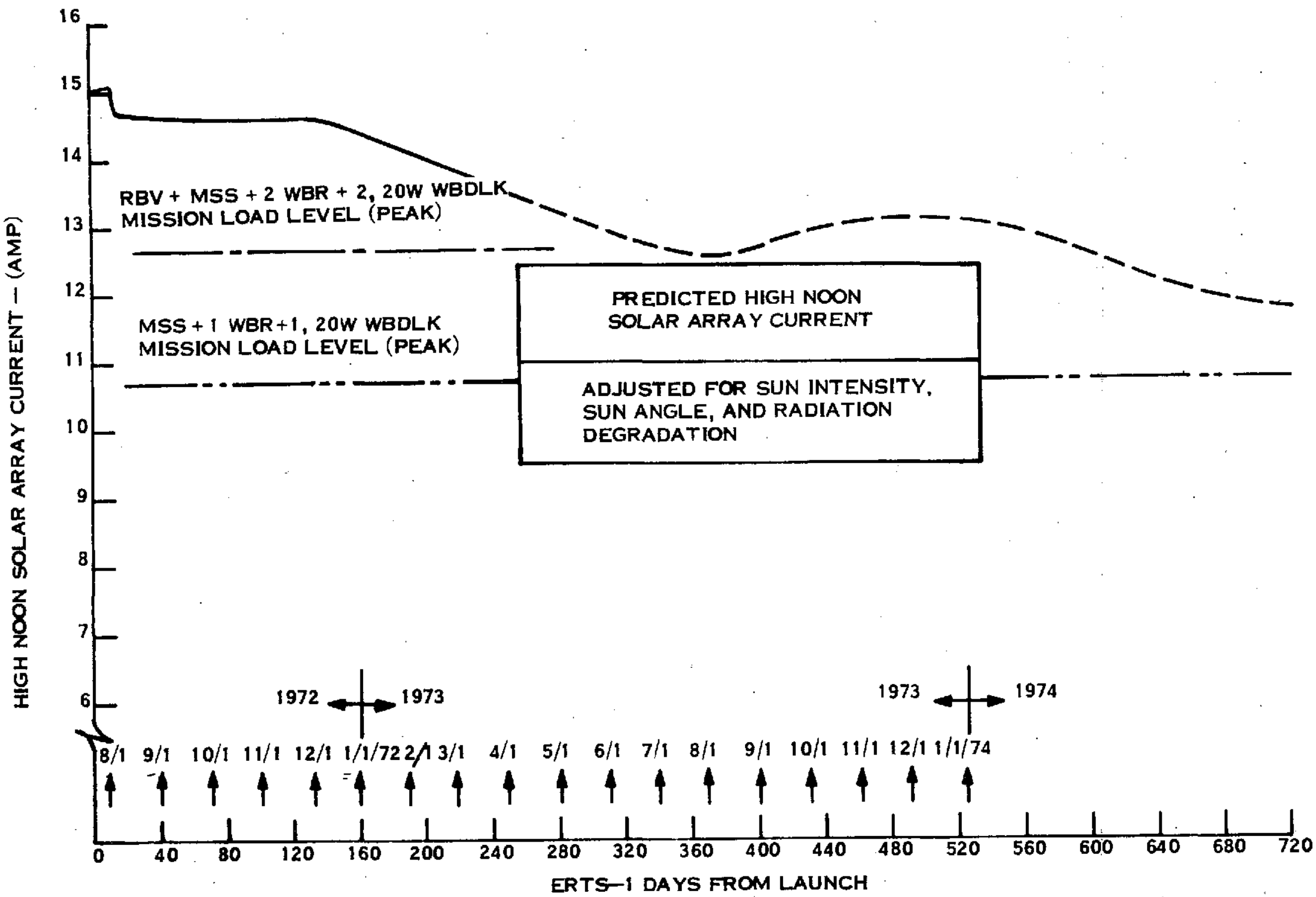

Figure 3-1. Predicted High Noon Solar Array Current

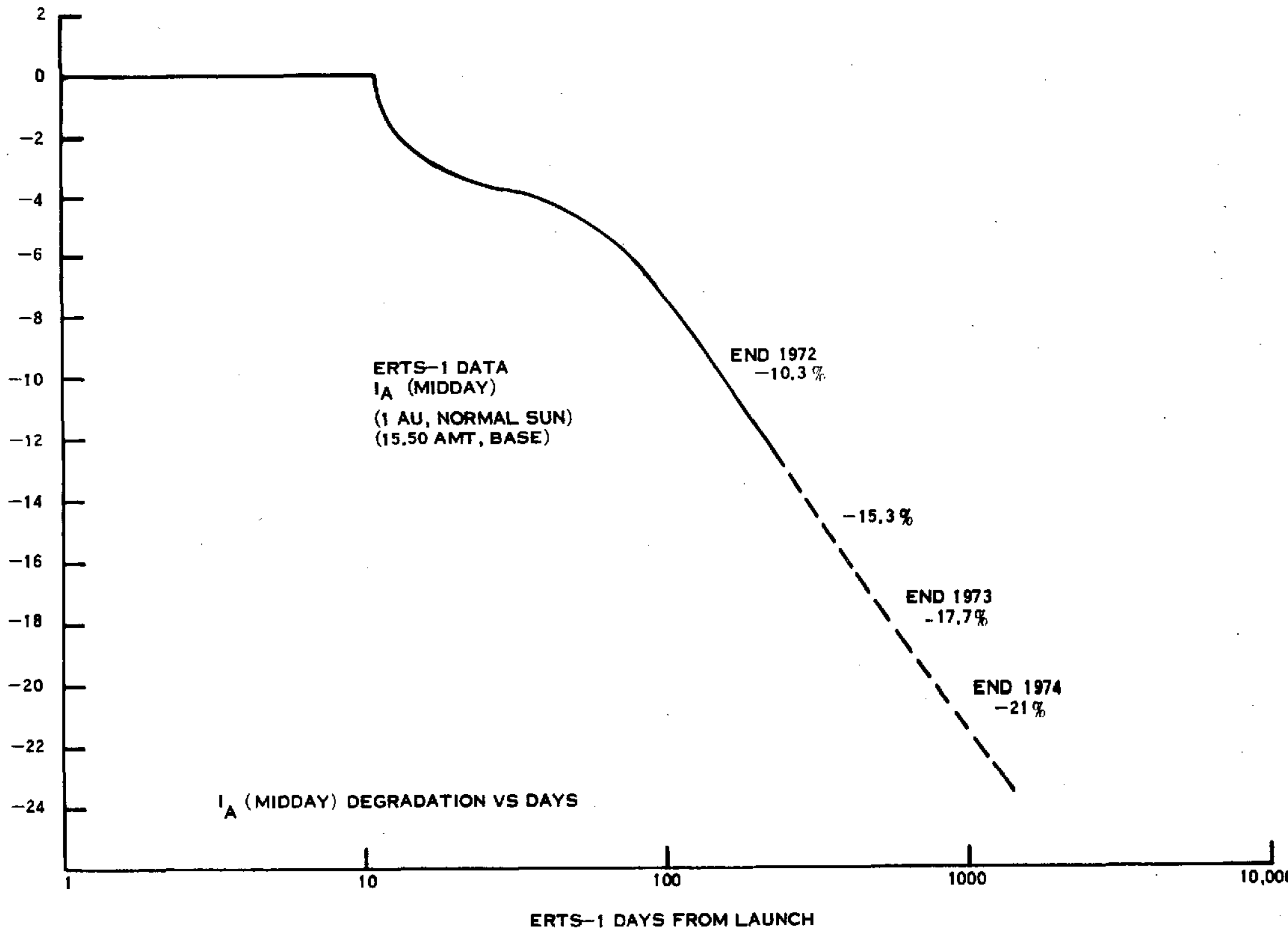

Figure 3-2. Solar Array Degradation

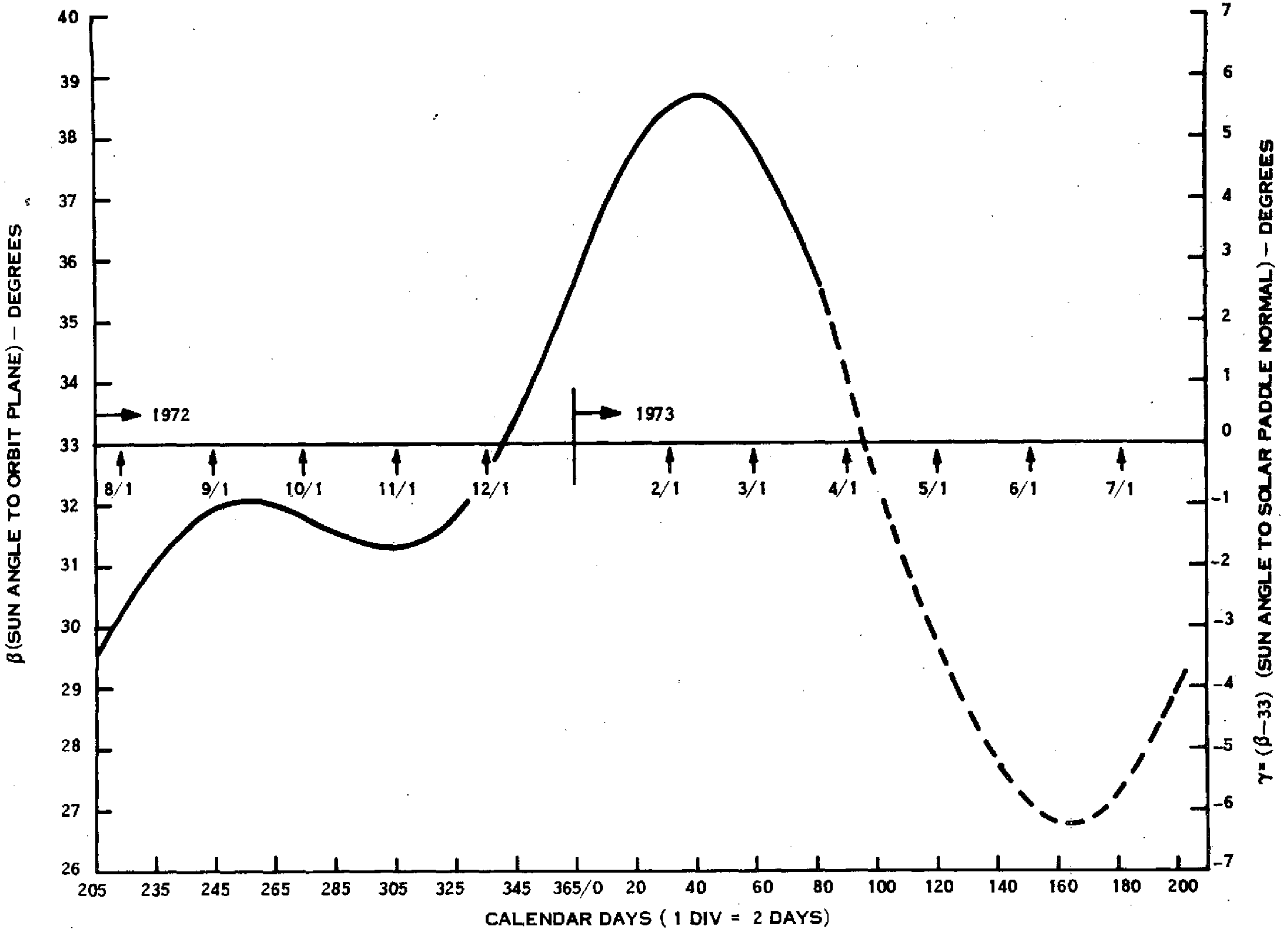

Figure 3-3. Actual and Predicted β and Paddle Sun Angles

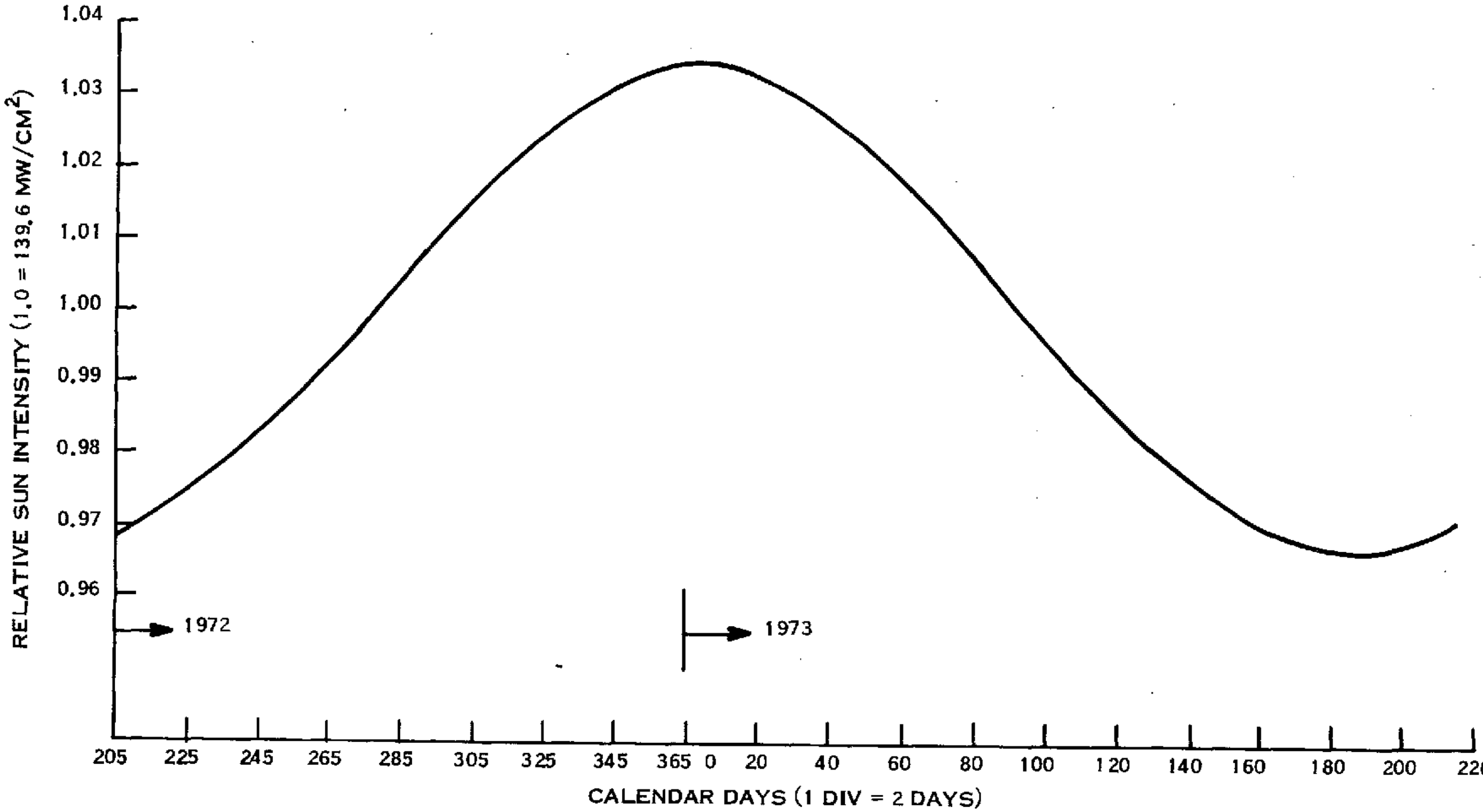

Figure 3-4. Seasonal Solar Intensity Variation

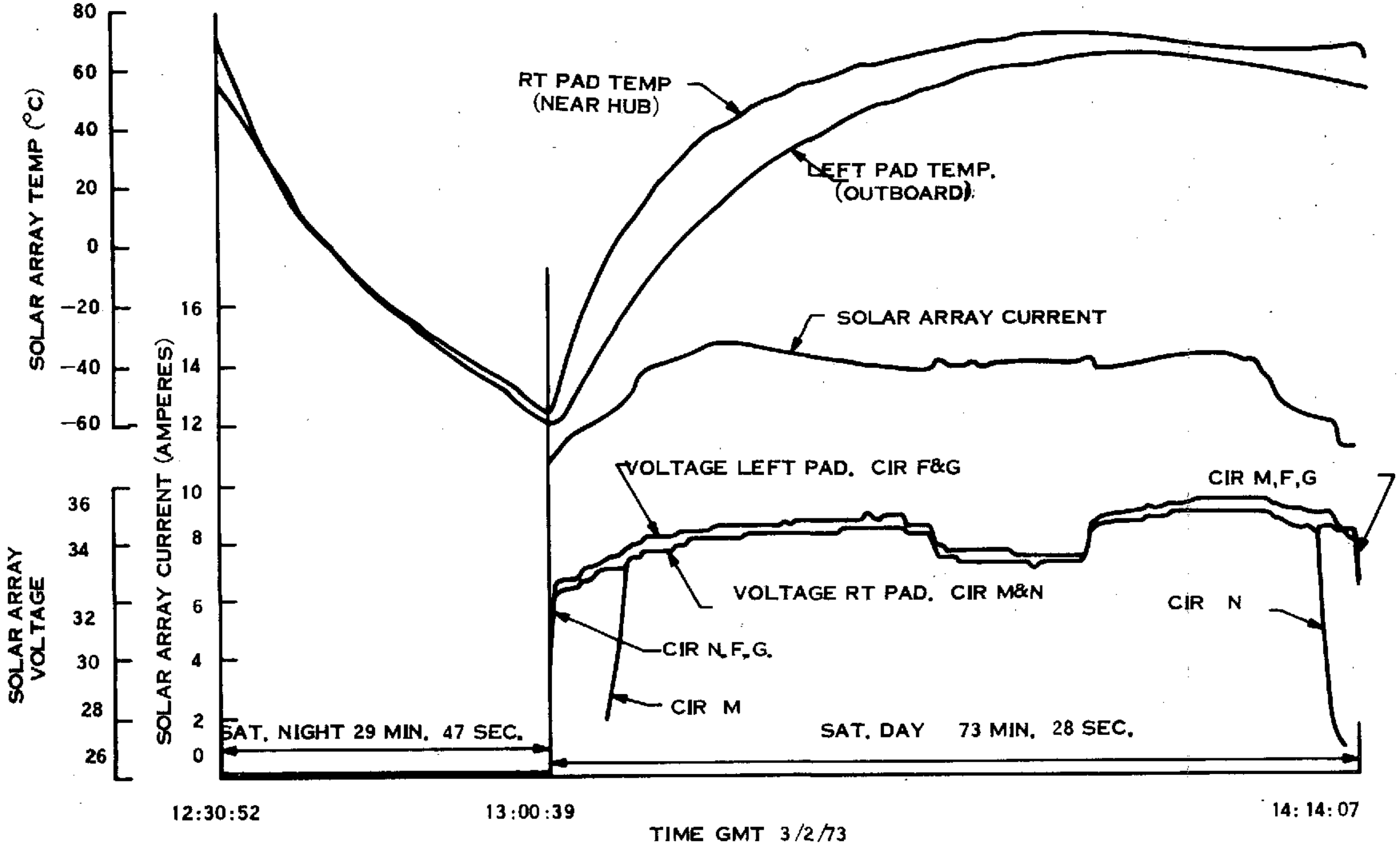

Figure 3-5. ERTS-1 Typical Solar Array Parameters

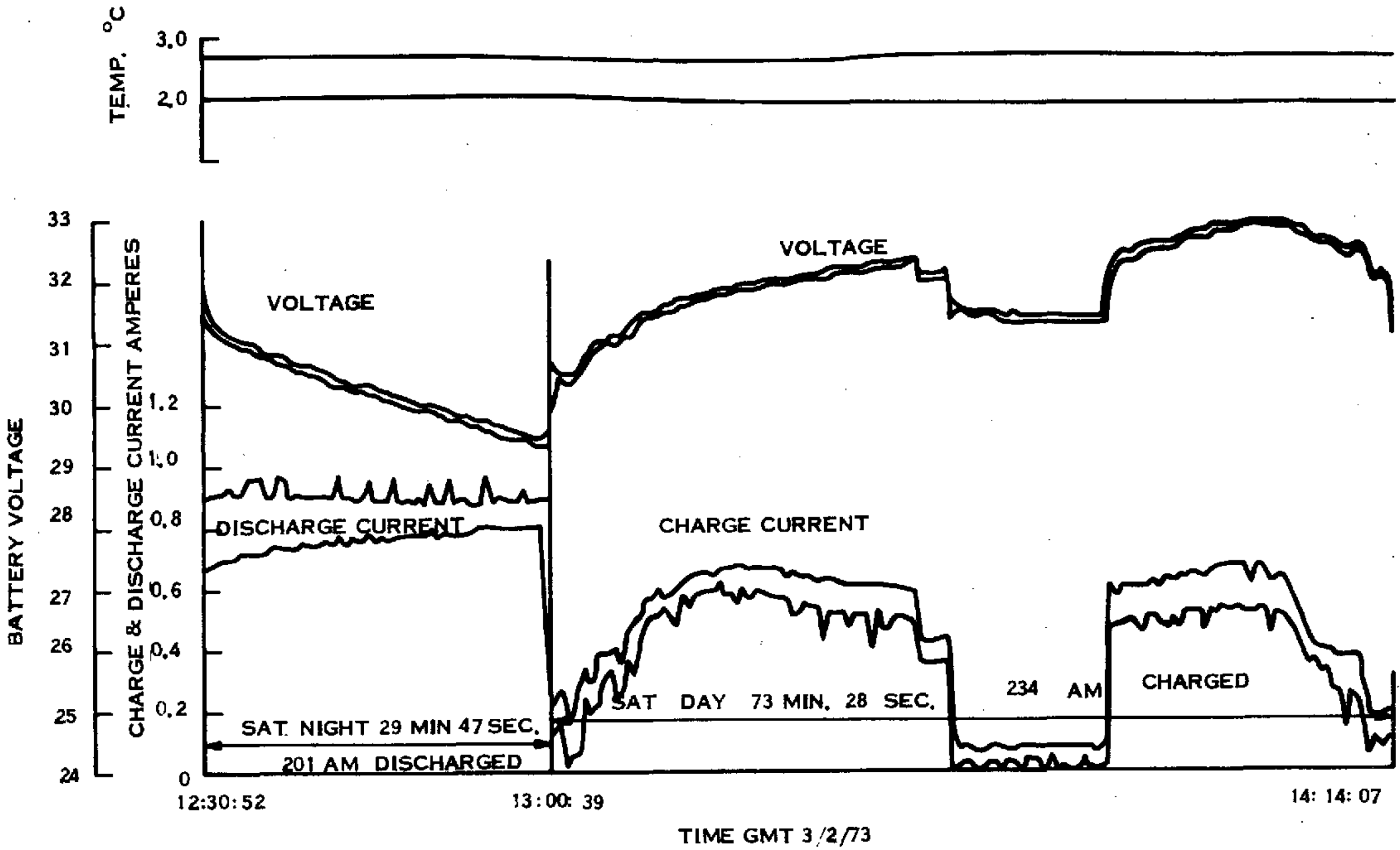

Figure 3-6. ERTS-1 Typical Battery Parameters

Table 3-1. Major Power Subsystems Parameters

Orbit No.			26	1291	2600	3000	3400	3810
Batt	1	Max	32.48	32.99	32.91	32.99	32.99	32.82
	2	Chge	32.48	32.99	32.91	32.99	32.91	32.82
	3	Volts	32.48	32.99	32.91	33.08	32.91	32.91
	4		32.48	32.99	32.91	33.08	32.99	32.91
	5		32.48	32.08	32.99	33.08	33.08	32.91
	6		32.31	32.99	32.91	32.99	32.99	32.91
	7		32.22	32.99	32.91	32.99	32.99	32.91
	8		32.14	32.99	32.91	33.08	32.99	32.91
	Average		32.28	33.00	32.92	33.04	32.99	32.88
Batt	1	End-	28.81	28.55	28.12	29.32	29.32	28.98
	2	of-	28.81	28.55	28.12	29.32	29.32	28.98
	3	Night	28.21	28.55	28.04	29.32	29.23	28.89
	4	Volts	28.89	28.55	28.12	29.41	29.32	28.98
	5		28.29	28.64	28.21	29.41	29.41	29.06
	6		28.81	28.55	28.04	29.32	29.23	28.89
	7		28.89	28.55	28.12	29.32	29.32	28.98
	8		28.81	28.55	28.12	29.32	29.23	28.98
	Average		28.84	28.56	28.11	29.34	29.30	28.97
Batt	1	Chge	13.11	13.29	13.00	13.20	13.46	13.76
	2	Share	12.93	12.95	13.00	13.30	13.17	13.63
	3	(%)	11.38	11.23	11.53	11.42	11.25	11.60
	4		12.39	12.29	12.13	12.27	12.24	12.36
	5		12.32	12.30	12.41	12.39	12.17	11.93
	6		12.80	12.74	12.82	12.66	12.62	12.21
	7		12.62	12.83	12.66	12.56	12.69	12.44
	8		12.45	12.36	12.45	12.20	12.39	12.05
Batt	1	Load	12.71	12.68	12.61	12.66	12.72	12.63
	2	Share	12.90	13.71	13.43	13.92	13.82	13.84
	3	(%)	11.43	12.09	12.11	12.34	12.00	12.18
	4		12.77	12.89	12.88	13.16	12.96	12.94
	5		12.54	12.32	12.29	12.02	12.14	12.20
	6		12.53	12.24	12.29	11.87	12.04	11.93
	7		12.80	12.33	12.27	12.36	12.39	12.55
	8		12.32	11.74	12.12	11.67	11.94	11.74
Batt	1	Temp	21.11	24.63	25.13	24.61	24.44	24.35
	2	in	18.74	21.37	22.33	21.33	20.84	21.69
	3	(°C)	18.77	20.36	20.72	20.04	19.73	20.31
	4		21.57	23.41	23.23	23.00	22.93	22.99
	5		21.02	24.67	26.77	26.29	25.17	23.77
	6		21.21	24.98	26.95	26.61	25.35	24.23
	7		21.41	25.64	27.18	26.62	25.81	24.73
	8		21.82	25.67	26.68	26.18	25.79	24.89
	Average		20.81	23.84	24.87	24.39	23.76	23.37
S/C Reg Bus Pwr (W)			176.8	168.0	182.3	157.9	156.9	170.5
Comp Load Part (W) (P/U S/C Reg Bus)			49.0	41.8	34.8	34.8	34.8	34.8
P/L Reg Bus Pwr (W)			16.2	19.6	36.1	15.4	9.7	8.9
C/D Ratio			1.06	1.17	1.08	1.24	1.25	1.18
Total Charge (A-M)			309.2	296.8	353.85	267.06	256.29	269.05
Total Discharge (A-M)			290.9	253.6	327.08	215.68	204.27	227.97
Solar Array (A-M)			1044	1033	1028	1001	. 979	952
S.A. Peak I (A)			15.8	15.36	15.10	14.92	14.48	14.21
Beta Logic (DES)			-3.33	-1.65	+5.15	+5.30	+2.50	-0.90
Max R Pad Temp (°C)			+65.0	+71.	+71.00	+71.00	+70.00	+68.00
Min R Pad Temp (°C)			-62.0	58.0	-56.00	-56.00	-58.00	-59.00
Max L Pad Temp (°C)			+57.9	+65.0	+66.00	+65.00	+63.12	+61.37
Min L Pad Temp (°C)			-67.0	-64.0	-60.00	-59.00	-63.00	-64.00

Table 3-2. Power Subsystem Analog Telemetry (Average Value for Frames of Data Received in NBTR Playback)

Function	Description	Unit	Orbit 26	Orbit 1291	Orbit 2600	Orbit 3000	Orbit 3400	Orbit 3810
6001	Bat 1 Disc	Amp	0.94	0.96	1.23	0.75	0.81	0.71
6002	2		0.95	1.03	1.29	0.82	0.87	0.78
6003	3		0.84	0.91	1.17	0.72	0.76	0.69
6004	4		0.93	0.98	1.23	0.78	0.81	0.78
6005	5		0.92	0.93	1.19	0.71	0.77	0.75
6006	6		0.91	0.93	1.20	0.70	0.75	0.70
6007	7		0.94	0.95	1.19	0.73	0.77	0.73
6008	8		0.91	0.90	1.18	0.69	0.74	0.73
6011	Bat 1 Chg		0.58	0.58	0.71	0.53	0.49	0.57
6012	2		0.57	0.56	0.71	0.53	0.48	0.57
6013	3		0.50	0.49	0.63	0.46	0.42	0.48
6014	4		0.54	0.54	0.66	0.50	0.46	0.51
6015	5		0.54	0.54	0.68	0.51	0.45	0.49
6016	6		0.57	0.55	0.70	0.51	0.47	0.51
6017	7		0.55	0.56	0.70	0.50	0.47	0.52
6018	8		0.55	0.54	0.69	0.49	0.46	0.50
6021	Bat 1 Volt	VDC	30.87	31.28	30.74	31.29	31.49	31.19
6022	2		30.87	31.28	30.74	31.30	31.48	31.19
6023	3		30.87	31.29	30.74	31.29	31.49	31.19
6024	4		30.90	31.32	30.77	31.32	31.52	31.22
6025	5		30.95	31.36	30.82	31.37	31.57	31.28
6026	6		30.86	31.27	30.72	31.27	31.48	31.18
6027	7		30.89	31.30	30.76	31.30	31.50	31.21
6028	8		30.89	31.30	30.75	31.30	31.51	31.21
6031	Bat 1 Temp	DGC	21.17	24.61	25.19	24.68	24.26	24.28
6032	2		18.80	21.36	22.44	21.43	20.62	21.55
6033	3		18.76	20.36	20.80	20.17	19.59	20.27
6034	4 4		21.57	23.41	23.20	23.14	22.93	22.94
6035	5		21.84	24.64	26.86	26.79	25.12	23.73
6036	6		21.24	24.99	26.99	26.58	25.26	24.17
6037	7		21.43	25.67	27.20	26.60	25.68	24.65
6038	8		21.86	25.66	26.75	26.20	25.64	24.87
6040	RT Pad Temp	DGC	25.82	30.33	27.98	25.80	32.32	28.46
6041	R Pad V N	VDC	33.40	33.96	33.01	33.28	33.88	33.77
6042	R Pad V M	VDC	33.29	33.59	32.43	31.92	33.07	33.34
6044	Lt Pad Temp	DGC	14.14	19.50	18.56	16.83	20.44	17.78
6045	L Pad V F	VDC	33.69	34.26	33.71	34.15	34.28	34.08
6046	L Pad V G	VDC	33.68	34.27	33.73	34.20	34.31	34.09
6050	S/C Ur Bus V	VDC	31.24	31.69	31.03	31.58	31.94	31.54
6051	S/C Rg Bus V	VDC	24.54	24.55	24.54	24.54	24.55	24.54
6052	Aux Reg A V	VDC	23.41	23.47	23.46	23.48	23.48	23.48
6053	Aux Reg B V	VDC	23.50	23.50	23.50	23.50	23.50	23.50
6054	Solar I	Amp	14.67	14.40	13.97	13.41	13.54	13.28
6055	S/C Rg Bus I	Amp	7.11	6.86	7.45	6.47	6.41	6.98
6056	S/C Rg Bus I	Amp	7.11	6.85	7.46	6.46	6.41	6.96
6058	PC Mod T1	DGC	21.82	22.81	23.53	22.27	21.83	22.78
6059	PC Mod T2	DGC	21.68	22.74	23.08	22.43	22.01	22.70
6070	P/L Rg Bus V	VDC	24.66	24.68	24.67	24.67	24.69	24.67
6071	P/L Ur Bus V	VDC	31.08	31.54	30.88	31.43	31.78	31.39
6072	P/L Rg Bus I	Amp	0.57	0.79	1.47	0.63	0.40	0.36
6073	P Aux A V	VDC	23.51	23.52	23.53	23.51	23.51	23.50
6074	P Aux B V	VDC	23.51	23.52	23.53	23.51	23.51	23.50
6075	Pr Mod T1	DGC	21.50	23.15	24.40	23.22	22.32	23.25
6076	Pr Mod T2	DGC	20.34	21.47	22.31	21.51	20.83	21.25
6079	Fuse Blow V	VDC	24.56	-	-	0.00	0.00	0.00
6080	Shunt 1 I	Amp	0.00	0.00	0.00	0.00	0.00	0.00
6081	2		0.00	0.00	0.00	0.00	0.00	0.00
6082	3		0.00	0.00	0.00	0.00	0.00	0.00
6083	4		0.00	0.00	0.00	0.00	0.00	0.00
6084	5		0.00	0.00	0.00	0.00	0.00	0.00
6085	6		0.00	0.00	0.00	0.00	0.00	0.00
6086	7		0.00	0.00	0.00	0.00	0.00	0.00
6087	8		0.00	0.00	0.00	0.00	0.00	0.00
6100	P/L Rg Bus I	Amp	0.58	0.79	1.47	0.63	0.39	0.36
Total No.	Major Frames	FRM	764	390	425	604	424	384

SECTION 4

ATTITUDE CONTROL SUBSYSTEMS

SECTION 4

ATTITUDE CONTROL SUBSYSTEM (ACS)

Performance of the Attitude Control Subsystem has been excellent throughout the launch and orbital operations.

Gating for the ACS has been as noted in Figure 4-1 and Table 4-1. The number of gates/orbit has decreased significantly during this period. Both Pitch and Roll combined have diminished from a peak of 1.4/orbit to a current value of 0.4/orbit. The long-term correlation with seasons and beta angle still tracks with gating frequency.

All ACS components have operated in a satisfactory manner throughout this period. Minor variations have been investigated but no specific problems found. The slight increase in yaw, roll and pitch motor drive duty cycle occurred several times as noted in Figure 4-2. These increased duty cycles returned to normal each time. Specific reasons for the increase is still under investigation.

Table 4-2 gives typical ACS telemetry values.

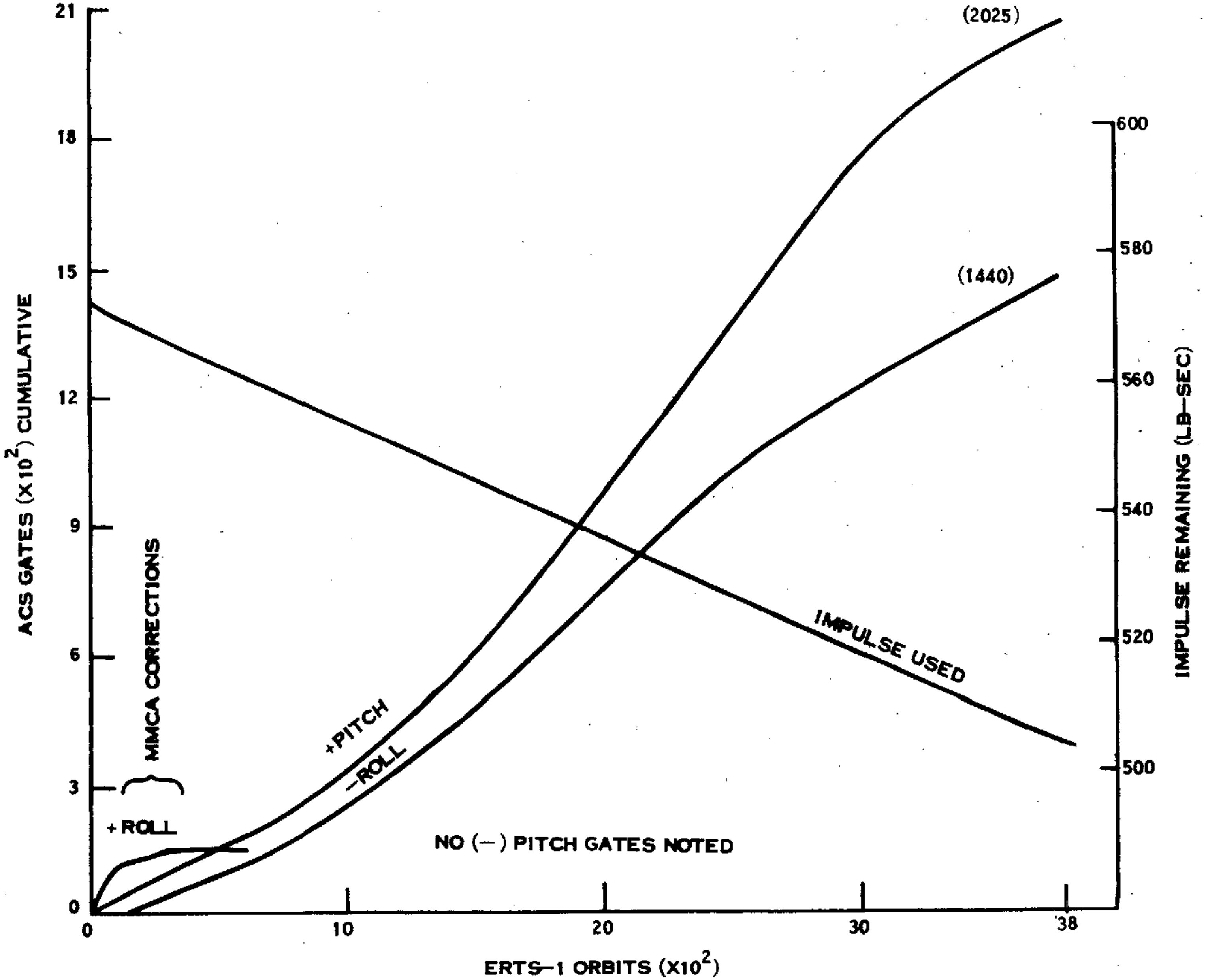

Figure 4-1. ACS Cumulative Gate History ERTS-1

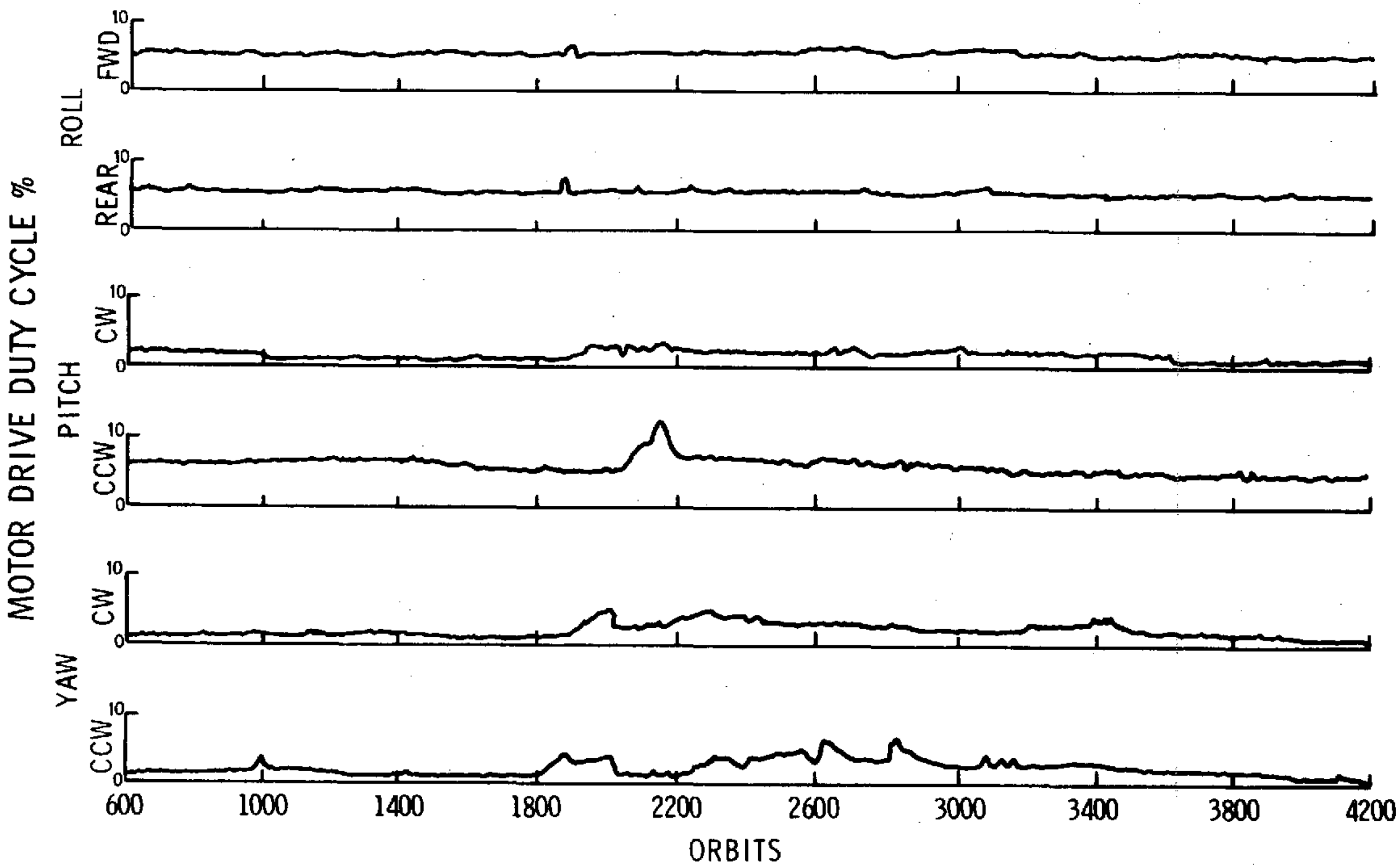

Figure 4-2. ACS Motor Drive Duty Cycle

Table 4-1. Impulse Usage ERTS-1

Item	Units	Orbits			
		0/1	1300	2600	3800
Gas					
Remaining (2)	Lbs	12.02	11.63	11.00	10.60
Usable Impulse (3)	Lb-Sec	575.2	555.7	524.2	504.2
Gates	Cumulative				
- Pitch		--	0	0	0
+ Pitch		--	475	1431	2025
- Roll		--	375	1030	1440
+ Roll		--	150	153 (1)	153
$W = \frac{PV}{CRT}$					

Where:

W = Weight of Freon-14 in lbs

P = Tank pressure in lbs/ft^3

V = Tank volume in ft^3 (0.272 for ERTS-1)

C = Compressibility factor for Freon-14

R = Universal gas constant (17.55 for Freon-14)

T = Tank temperature degrees Rankine

(1) 3 (+) roll gates during orbit adjust (Orbit 2416)
(2) 0.516 lbs of Freon not usable due to manifold lock up pressure
(3) Freon-14 specific impulse = 50 lb-sec/lb

Table 4-2. ACS Temperature and Pressure Telemetry Summary

Function	Units	*T/V 20°C Plateau	Orbit			
			31	3000	3400	3810
1084 RMP 1 Gyro Temperature	DGC	79.0	44.5	24.07	23.78	23.50
1094 RMP 2 Gyro Temperature	DGC	73.0	74.3	75.08	75.08	75.07
1222 SAD RT MTR HSING Temp	DGC	28.0	21.1	22.74	22.42	22.34
1242 SAD LT MTR HSING Temp	DGC	27.0	27.0	32.11	31.50	30.98
1223 SAD RT MTR WNDNG Temp	DGC	29.0	25.3	27.09	26.73	26.98
1243 SAD LT MTR WNDNG Temp	DGC	29.0	28.7	34.76	34.13	33.56
1228 SAD RT HSG Pressure	PSI	7.57	7.6	7.52	7.47	7.42
1248 SAD LT HSG Pressure	PSI	6.91	7.0	7.03	6.98	6.93
1007 FWD Scanner MTR Temp	DGC	17.00	19.8	21.03	20.81	20.22
1016 Rear Scanner MTR Temp	DGC	25.00	20.5	21.14	20.70	20.25
1003 FWD Scanner Pressure	PSI	4.80	4.6	4.40	4.40	4.22
1012 Rear Scanner Pressure	PSI	5.16(1)	7.8	8.05	7.88	7.90
1212 Gas Tank Pressure	PSI	1810.	1988.	1798.99	1773.41	1753.03
1210 Gas Tank Temperature	DGC	20.0	22.6	25.71	25.20	24.87
1213 Manifold Pressure	PSI	57.53	56.7	57.25	57.28	57.50
1211 Manifold Temperature	DGC	24.0	21.9	25.20	24.54	24.18
1059 CLB Power Supply Card Temp	DGC	36.0	37.1	42.12	41.64	41.04
1260 THO1 EBP	DGC	26.0	25.4	29.63	29.06	28.53
1081 RMP 1 MTR Volts	VDC	-30.13	Off	Off	Off	Off
1082 RMP 1 MTR Current	Amps	0.11	Off	Off	Off	Off
1080 RMP 1 Supply Volts	VDC	-23.88	Off	Off	Off	Off
1091 RMP 2 MTR Volts	VDC	-29.68	-29.7	-29.63	-29.63	-29.63
1092 RMP 2 MTR Current	Amps	0.10	0.10	0.10	0.10	0.10
1090 RMP 2 Supply Volts	VDC	-23.46	-23.4	-23.39	-23.40	-23.39
1220 SAD RT MTR WNDNG Volts	VDC	-5.0	-4.8	-4.37	-4.25	-4.36
1240 SAD LT MTR WNDNG Volts	VDC	-5.2	-4.8	-4.08	-4.10	-4.13
1227 SAD RT -15 VDC Conv.	VDC	-14.88	14.9	14.89	14.88	14.89
1247 SAD LT -15 VDC Conv.	VDC	-15.12	15.2	15.13	15.14	15.14
1056 CLB ± 6 VDC	TMV	2.33	2.4	2.35	2.35	2.35
1055 CLB ± 10 VDC TMV	TMV	2.73	2.75	2.75	2.75	2.75
1057 CLB Power Supply Volts	TMV	2.77	2.8	2.79	2.78	2.78
1261 THO2 EBP	DGC	23.0	22.9	26.23	25.92	25.26
1262 THO3 EBP	DGC	25.0	23.4	24.83	24.59	24.17
1263 THO1 STS	DGC	-8.0	-6.8	2.01	2.88	0.16
1264 THO2 STS	DGC	-11.0	-14.6	-6.36	-7.03	-7.39
1265 THO3 STS	DGC	-12.0	-3.1	10.78	12.43	9.36
1266 THO4 STS	DGC	4.0	-13.9	-2.79	1.96	-0.90
1267 THO5 STS	DGC	-2.0	-8.9	3.18	5.04	1.25
1224 SAD R FSST	DGC	28.0	39.5	52.45	53.45	54.16
1244 SAD L FSST	DGC	22.0	27.1	46.01	44.30	44.39

(1) Scanner S/N FT-3 in thermo-vacuum scanner - S/N FT-6 in flight

* Thermal Vacuum Test Data

SECTION 5

COMMAND/CLOCK SUBSYSTEM

SECTION 5

COMMAND/CLOCK SUBSYSTEM

Command processing for both real time and stored commands for ERTS-1 has been normal during this period except for one minor problem with one COMSTOR cell which will be noted later.

Commanding difficulties which have been experienced have been isolated to ground transmission problems.

Several commands have been missed which were attributed to the logic race in the command clock design. This is expected for 1 in 10,000 commands (somewhat more were noted in ERTS-1 test (approximately 1 in 3000) but flight experience seems more in line with 1 in 10,000). (See Appendix B, PRI 1J83-NE-759.) Nine have been noted in approximately 80,000 commands. The time base provided by the S/C clock has been well within specifications during this period. Drift has averaged -1.14 m.s./orbit. See Figure 5-1. Spacecraft time code transmitted via MSS and Telemetry has been reliable and accurate. All frequency outputs to other subsystems have been nominal.

There has been no occasion to switch to alternate units from original configuration.

In Orbit 583 in the Bermuda pass during an attempted COMSTOR load cell 12 of COMSTOR B gave a return that was 256 seconds higher than entered. Cell 12 loaded with 525 "Inv A ON" for 14:57:20; verified as 525 for 15:01:36. The same Δ time was noted in Cell 12, COMSTOR B as listed in Table 5-1. In three cases noted the Δ time was 256 sec lower than entered. On second try COMSTOR loaded normally each time. This intermittent problem is under further investigation.

Table 5-2 gives typical telemetry values.

The VHF command Receiver-B has operated flawlessly since launch. Receiver A has not yet been used. Interference has frequently been observed in strip charts and telemetry data, but this has had no impact on the operational functions.

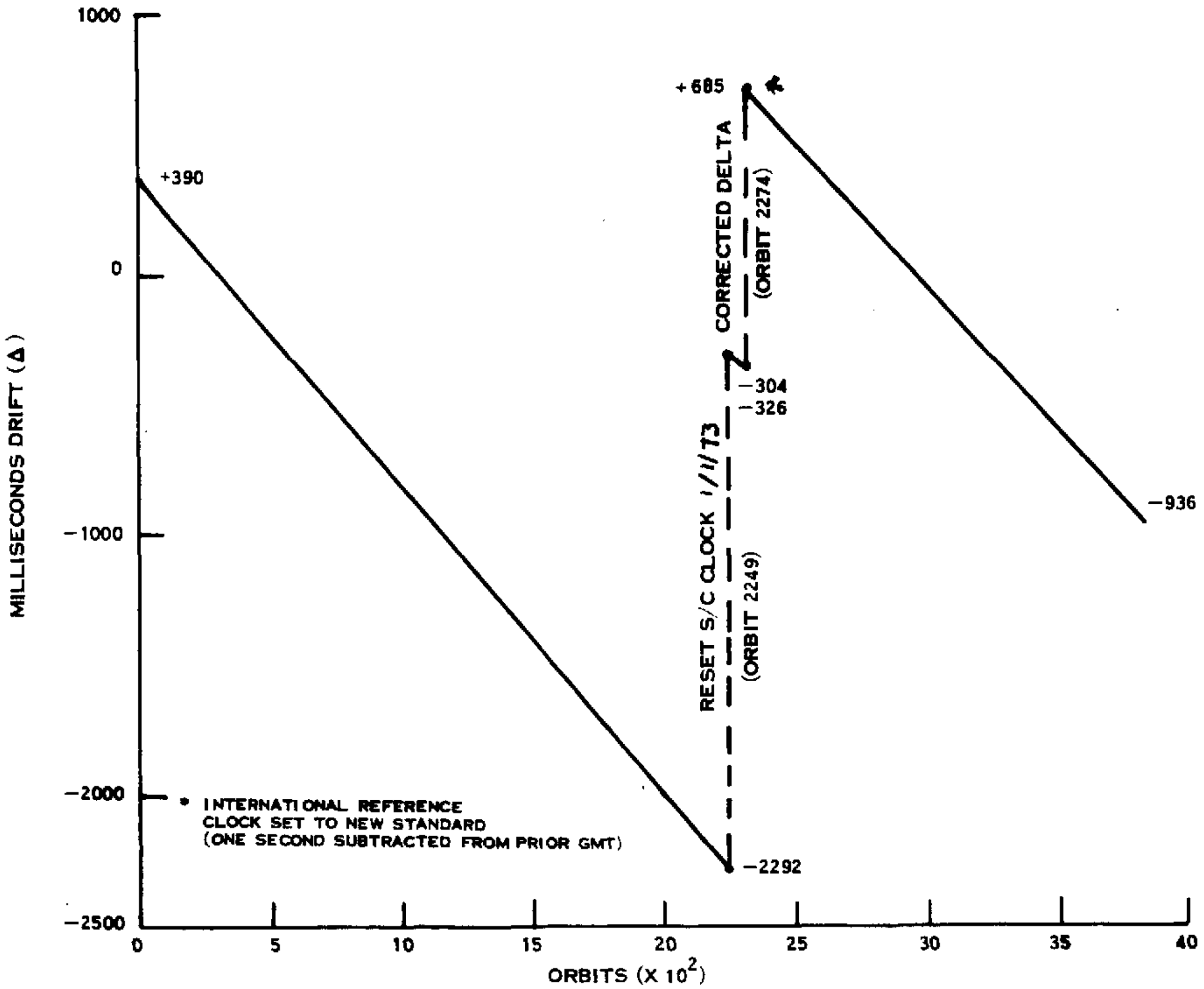

Figure 5-1. Command Clock Drift Summary

Table 5-1. Summary of Cell 12 COMSTOR 'B' (Δ Time 256 Sec)

Orbit	Δ Time	Station
583	H	Bermuda
635	H	Alaska
891	H	Greenbelt
1225	H	Greenbelt
1254	H	Greenbelt
1538	H	Greenbelt
1696	L	Alaska
1699	H	Greenbelt
1719	H	Alaska
1803	L	Greenbelt
1852	L	Bermuda
1983	H	Alaska
2189	H	Goldstone
2739	NR	Greenbelt
2860	NR	Alaska
2898	NR	Greenbelt
3141	H	Alaska
3429	H	Greenbelt
3640	H	Alaska
3686	H	Alaska
3746	NR	Alaska
3760	L	Alaska
3790	L	Bermuda

H - Δ time 256 seconds higher than entered.
L - Δ time 256 seconds lower than entered.
NR - Not Recorded

Table 5-2. Command/Clock Telemetry Summary

Function No.	Name	Mode	Units	* T/V Plateau 20°C	Orbit 35	Orbit 3000	Orbit 3400	Orbit 3810
8005	Pri. Power Supply Temp	-	°C	37.0	37.31	38.88	38.87	39.37
8006	Red. Power Supply Temp	-	°C	41.3	35.73	37.57	37.53	38.05
8007	Pri. Osc. Temp	-	°C	31.1	31.14	31.61	31.73	31.97
8008	Red. Osc. Temp	-	°C	30.3	30.47	30.91	31.02	31.40
8009	Pri. Osc. Output	-	TMV	1.07	0.95	0.96	0.95	0.96
8010	Red. Osc. Output	-	TMV	0.98	**	**	**	**
8011	100 kHz	Pri. - Red.	TMV	3.10	3.11	3.11	3.11	3.10
8012	10 kHz	Pri. - Red.	TMV	3.07	3.10	3.08	3.07	3.08
8013	2.5 kHz	Pri. - Red.	TMV	2.95	2.95	2.95	2.95	2.95
8014	400 Hz	Pri. - Red.	TMV	4.40	4.40	4.40	4.40	4.40
8015	Pri. +4V Power Supply	Pri. Clk ON	VDC	4.10	4.10	4.10	4.10	4.10
8016	Red. +4V Power Supply	Red. Clk ON	VDC	3.98	3.95	3.95	3.95	3.95
8017	Pri. +6V Power Supply	Pri. Clk ON	VDC	6.07	6.06	6.07	6.07	6.07
8018	Red. +6V Power Supply	Red. Clk ON	VDC	5.95	6.00	5.94	5.93	5.94
8019	Pri. -6V Power Supply	Pri. Clk ON	VDC	-6.02	-6.02	-6.02	-6.02	-6.03
8020	Red. -6V Power Supply	Red. Clk ON	VDC	-6.02	-5.99	-6.00	-5.99	-6.00
8021	Pri. -23V Power Supply	Pri. Clk ON	VDC	-22.96	-22.88	-22.89	-22.89	-22.89
8022	Red. -23V Power Supply	Red. Clk ON	VDC	-23.0	-22.98	-23.01	-22.99	-23.00
8023	Pri. -29V Power Supply	Pri. Clk ON	VDC	-29.2	-29.13	-29.15	-29.15	-29.14
8024	Red. -29V Power Supply	Red. Clk ON	VDC	-29.2	-29.07	-29.21	-29.21	-29.21
8101	CIU A -12V	CIU A ON	VDC	-12.3	-12.33	-12.33	-12.33	-12.33
8102	CIU B -12V	CIU B ON	VDC	-12.2	-12.26	-12.25	-12.25	-12.25
8103	CIU A -5V	CIU A ON	VDC	-5.34	-5.32	-5.34	-5.34	-5.34
8104	CIU B -5V	CIU B ON	VDC	-5.30	-5.31	-5.31	-5.31	-5.31
8105	CIU A Temp	CIU A ON	°C	24.3	24.47	24.77	24.64	24.77
8106	CIU B Temp	CIU B ON	°C	24.6	24.96	25.26	25.12	25.34
8201	Receiver RF-A Temp	-	°C	29.0	**	**	**	**
8202	Receiver RF-B Temp	-	°C	28.5	27.98	28.13	28.02	28.36
8203	D MOD A Temp	-	°C	37.5	25.41	25.49	25.51	25.80
8204	D MOD B Temp	-	°C	35.4	35.03	35.31	35.41	35.52
8205	Receiver A AGC	Receiver A ON	DBM	-70.0	**	**	**	**
8206	Receiver B AGC	Receiver B ON	DBM	-57.0	-94.74	-94.07	-92.05	-98.98
8207	Amp. A Output	Receiver A ON	RMV	1.50	**	**	**	**
8208	Amp B Output	Receiver B ON	TMV	1.54	2.81	2.85	3.01	2.61
8209	Freq. Shift Key A OUT	Receiver A ON	TMV	1.11	**	**	**	**
8210	Freq. Shift Key B OUT	Receiver B ON	TMV	1.10	1.10	1.11	1.10	1.10
8211	Amp. A Output	Receiver A ON	TMV	1.11	**	**	**	**
8212	Amp. B Output	Receiver B ON	TMV	1.13	1.13	1.13	1.13	1.12
8215	D MOD A -15V	Receiver A ON	TMV	4.98	**	**	**	**
8216	D MOD B -15V	Receiver B ON	TMV	4.99	5.00	5.00	5.00	5.00
8217	Regulator A -10V	Receiver A ON	TMV	5.39	**	**	**	**
8218	Regulator B - 10V	Receiver B ON	TMV	5.50	5.50	5.50	5.50	5.50

* Thermal Vacuum Test Data

** A component not used since prelaunch

SECTION 6

TELEMETRY SUBSYSTEM

SECTION 6

TELEMETRY SUBSYSTEM

The Telemetry Subsystem was launched in the ON mode and has been operating continuously since then providing data from the spacecraft either to ground stations, the narrow band recorders, or both. Typical telemetry values are given in Table 6-1. Only memory Section 0.0 has been used in the telemetry matrix. Total performance has been excellent.

Table 6-1. TLM Telemetry Summary

Function No.	Function Name	Unit	T/V* 20°C Plateau	Orbit 35	Orbit 3000	Orbit 3400	Orbit 3810
9001	Memory Sequencer A Converter	VDC	6.34	6.35	6.33	6.33	6.33
9002	Memory Sequencer B Converter	VDC	6.44	**	**	**	**
9003	Memory Sequencer Temp.	°C	20.1	19.59	21.18	21.36	20.96
9004	Formatter A Converter	VDC	5.99	5.99	5.99	5.99	5.99
9005	Formatter B Converter	VDC	6.02	**	**	**	**
9006	Dig. Mux A Converter	VDC	10.02	10.01	10.07	10.06	10.04
9007	Dig. Mux B Converter	VDC	10.01	**	**	**	**
9008	Formatter/Dig. Mux Temp.	°C	22.2	22.50	27.30	25.04	24.76
9009	Analog Mux A Converter	VDC	26.18	26.01	26.18	26.18	26.18
9010	Analog Mux B Converter	VDC	26.21	**	**	**	**
9011	A/D Converter A Voltage	VDC	10.00	10.00	10.07	10.07	10.07
9012	A/D Converter B Voltage	VDC	10.06	**	**	**	**
9013	Analog MUX A/D Converter	°C	26.7	25.00	27.50	27.46	27.16
9014	Preregulator A Voltage	VDC	19.91	19.93	19.99	19.96	19.98
9015	Preregulator B Voltage	VDC	19.88	**	**	**	**
9016	Reprogrammer Temp.	°C	19.9	22.0	24.86	23.80	22.58
9017	Memory A Converter	VDC	6.00	6.00	6.00	6.00	6.00
9018	Memory A Temp.	°C	19.3	17.51	17.50	17.51	17.71
9019	Memory B Converter	VDC	6.03	**	**	**	**
9020	Memory B Temp.	°C	17.4	17.68	18.81	18.51	18.07
9100	Reflected Power (Xmtr A)	dBm	0	11.95	13.11	13.00	12.46
9101	Xmtr A -20 VDC	VDC	-19.76	-19.75	-19.76	-19.75	-19.76
9102	Xmtr B -20 VDC	VDC	-19.79	**	**	**	**
9103	Xmtr A Temp.	°C	20.5	20.95	24.09	22.52	21.35
9104	Xmtr B Temp.	°C	20.0	21.69	24.98	23.18	22.09
9105	Xmtr A Power Output	dBm	25.48	25.12	25.43	25.71	25.36
9106	Xmtr B Power Output	dBm	25.84	**	**	**	**

* Thermal Vacuum Test Data
** Units not used since prelaunch

SECTION 7

ORBIT ADJUST SUBSYSTEM (OAS)

SECTION 7
ORBIT ADJUST SUBSYSTEM (OAS)

The Orbit Adjust Subsystem has not been exercised during this report period. Table 7-1 is a summary of OAS performance to date and Table 7-2 gives average telemetry values for the off quiescent state. Subsystem status is nominal.

Table 7-1. Orbit Adjust Performance

Orbit	Burn Time (sec)	Average Sma (2) (KM)	Performance % of Plan	N_2H_4 Used # (3)
(1)	-	7281.461	-	-
38	4.8	7281.484	60.0	0.018
44	251.0	7283.456	103.5	0.934
59	318.0	7285.838	101.5	1.19
938	12.8	7285.877	110.0	0.044
2416	20.4	7285.877	106.0	0.076
	Average Force 0.81 LB_f			

(1) After Injection
(2) Semi-Major Axis
(3) Initial fuel load 67.0 pounds

Table 7-2. OAS Telemetry Values

Function No.	Name	Units	*T/V 20°C Plateau	Orbit 35	3000	3400	3810
2001	Prop. Tank Temp.	°C	18.2	22.03	23.69	23.28	23.28
2003	Thrust Chamber No. 1 (-x) Temp. (1)	°C	20.9	29.57	29.70	28.21	31.60
2004	Thrust Chamber No. 2 (+x) Temp. (1)	°C	19.7	38.76	34.24	39.33	39.45
2005	Thrust Chamber No. 3 (-y) Temp. (1)	°C	18.9	34.55	45.37	41.47	35.92
2006	Line Pressure	Psia	4.0	539.29	486.83	486.78	486.87

* Thermal Vacuum Test Data

(1) Wide spread of temperature is due to nozzle locations and satellite day/night transitions relative to data averaged. Typical orbital range is from 19 to 59 DGC.

SECTION 8

MAGNETIC MOMENT COMPENSATING ASSEMBLY

SECTION 8

MAGNETIC MOMENT COMPENSATING ASSEMBLY (MMCA)

The spacecraft was corrected for unbalanced magnetic moments in orbits 73, 85, 110 and 220. Adjustments were made in the pitch positive. The unit responded well as noted in Table 8-1 and has held its charge. The current dipole values are Pitch + 2950 Pole-Cm, roll zero, yaw zero. These values are unchanged since Orbit 220. Table 8-2 gives typical telemetry for the MMCA.

Table 8-1. MMCA Telemetry Before and After Adjustment

		Orbits							
Function	Units	72	75	83	88	106	115	218	224
4003	TMV	3.49	3.48	3.48	3.48	3.47	3.49	3.50	3.50
4004	TMV	3.11	3.11	3.11	3.11	3.11	3.11	3.11	3.11
	Pole-Cm	≈0	≈0	≈0	≈0	≈0	≈0	≈0	≈0
4005	TMV	3.13	2.87	2.87	2.77	2.77	2.65	2.65	2.52
	Pole-Cm	≈0	1200	1200	1800	1800	2350	2350	2950
4006	TMV	3.18	3.20	3.20	3.20	3.18	3.18	3.18	3.18
	Pole-Cm	≈0	≈0	≈0	≈0	≈0	≈0	≈0	≈0

Table 8-2. MMCA Telemetry Summary

			T/V 20°C*	Orbit			
Number	Name	Units	Plateau	35	3000	3400	3810
4001	A1 Board Temp	°C	19.8	19.77	19.02	18.93	19.26
4002	A2 Board Temp	°C	23.6	23.58	22.98	22.95	23.17
4003	Hall Current	TMV	3.50	3.48	3.48	3.48	3.48
4004	Yaw Flux Density	TMV	3.07	3.11	3.09	3.09	3.10
4005	Pitch Flux Density	TMV	3.12	3.13	2.51	2.50	2.52
4006	Roll Flux Density	TMV	3.22	3.19	3.18	3.18	3.19

SECTION 9

UNIFIED S-BAND/PREMODULATION PROCESSOR

SECTION 9

UNIFIED S-BAND/PREMODULATION PROCESSOR

The Unified S-Band Subsystem (USB) has operated satisfactorily since separation late in Orbit zero.

The USB Receiver A has been ON continuously since launch for a total of 6556 hours, available to any USB ground station for commands and ranging. Only Receiver A has been used to date.

The USB Transmitter A has been ON for 852 hours, available on command for transmission of telemetry, DCS information, and ranging data. Only Transmitter A has been used to date.

Table 9-1 lists telemetry values for orbits in this reporting period. All functions have maintained their original values except for transmitter power output (Function 11002), which has decreased from a value of 1.60 watts in Orbit 1 to a value of 0.29 watts in Orbit 3810. Figure 9-1 shows the power output history. Continuing analysis of the lowest power output required to sustain all operating functions with a reasonable margin, yields 0.15 watts as the value requiring consideration of transferring to the B-section of the USB. There is currently no deterioration to any of the operating functions of the USB.

The decline in power output was confirmed as real and not simply erroneous telemetry measurements by a study, included in Appendix B. In this study, ground station AGC levels showed close correlation to the telemetry-indicated USB power decline.

The deterioration was localized to the transmitter unit by analysis of the spacecraft USB receiver AGC immediately before and after telemetry indicated step-downs in power. The AGC level was not affected. This shows that the deterioration was not in the USB antenna or diplexer which are shared by both the receiver and transmitter.

Table 9-1. USB/PMP Telemetry Values

Function		Units	20°C Plateau	Orbit			
No.	Name		*TV	35	3000	3400	3811
11001	USB Revr. AGC	DBM	-127.24	-122.78	-129.36	-126.95	-130.04
11002	USB Trans. Pwr	WTS	1.60	1.60	0.42	0.36	0.29
11003	Receiver Error	KHZ	-24.33	-21.79	-21.70	-20.57	-22.77
11004	Transp. Temp.	DGC	20.37	22.92	25.16	23.65	23.04
11005	Transp. Pressure	PSI	15.68	15.91	16.08	15.97	15.91
11007	Trans A-15VDC	VDC	-15.16	-15.20	-15.20	-15.20	-15.20
11009	Ranging -15VDC	VDC	-14.76	-14.76	-14.75	-14.75	-14.76
11101	PMP A Volt	VDC	-15.21	-15.21	-15.18	-15.16	-15.17
11103	PMP A Temp.	DGC	23.14	30.44	33.78	31.56	30.56

*Thermal Vacuum Test Data; from EAB-FT-1 (unit changed to EAB-FT-2 for flight).

NOTE: Only "A" Unit has turned on.

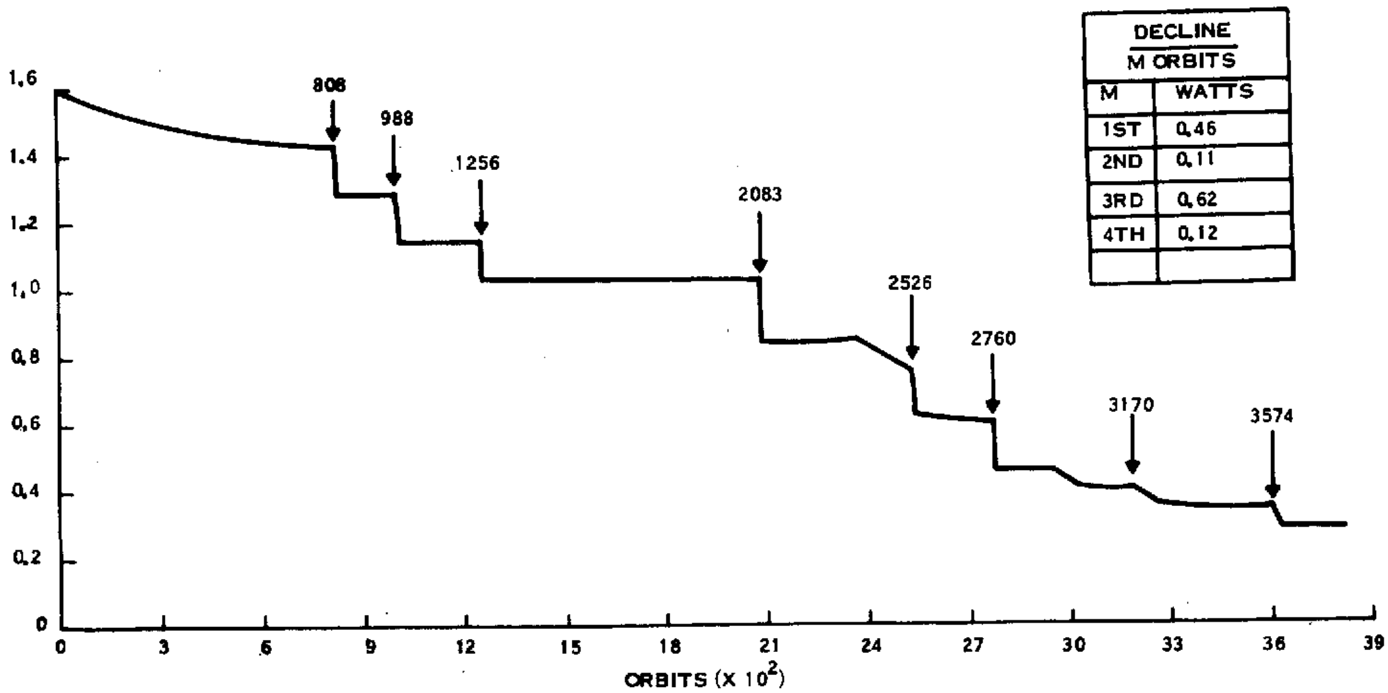

Figure 9-1. Power Output History of USB - A

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM

SECTION 10

ELECTRICAL INTERFACE SUBSYSTEM

Auxiliary Processing Unit (APU) consists of Search Track Data, Time Code Data, and Back-up Timers which operated satisfactorily throughout this report period. Telemetry for the APU is shown in Table 10-1. The APU is in Normal mode.

Table 10-1. APU Telemetry Functions

Functions	Description	Unit	Orbit 7	Orbit 3000	Orbit 3400	Orbit 3810
13200	APU, -24.5 VDC	VDC	24.90	24.90	24.91	24.90
13201	APU, -12 volts	VDC	12.08	12.08	12.08	12.08
13202	APU Temp.	DGC	25.49	28.41	27.33	26.90

The Power Switching Module (PSM) contains the switching relays for power to Orbit Adjust, MSS, WBVTR No. 1 and No. 2, RBV and PRM. The MSS and WBVTR No. 1 power circuits have been operated on a regular basis throughout this report period. The power relay for the RBV remained in a closed condition since orbit 196, but the RBV remained off by relays in the individual cameras and camera electronics. The WBVTR No. 2 remained off due to the failure occurring in orbit 148.

The Interface Switching Module (ISM) performed all switching normally during this report period. Compensation Loads changes were exercised in this report period.

SECTION 11

THERMAL CONTROL SUBSYSTEM

SECTION 11

THERMAL SUBSYSTEM

The Thermal Subsystem has maintained spacecraft temperature control over a satisfactory range during this report period. Table 11-1 shows average analog telemetry values from data recorded on the NBTR. During this report period, the sun intensity decreased as shown in Figure 3-4 for day 23 to day 114. This caused a gradual decrease in temperature of about 0.5^{o} to 2^{o}C around the spacecraft as shown in Figure 11-1 between orbit 2600 and 3810.

The solar panel temperature and the sun sensor temperature have maintained their same temperature profile except that during this report period they have slightly decreased in maximum values due to the decreasing sun intensity. A re-analysis of the ERTS-1 Solar Array Thermal performance is in PIR-1R54-ERTS-681 contained in Appendix B. Revision of the thermal model gave closer predictions to the upper temperature achieved on the solar panels in flight.

In Orbit 3483 compensation load number 3 was turned on to control the Wide Band Electronics Unit Number 1 while the Wide Band Tape Recorder was off or in limited use during the anomaly investigation. After heavier use of WBVTR No. 1 and because of decreased solar array energy, the compensation load number 3 was turned off to allow better power management of the power system. Compensational load history is shown in Table 11-2.

Table 11-1. Thermal Subsystem Analog Telemetry (Average Value for Frames of Data Received in NBTR Playback)

Function		Unit	Orbits					
Function No.	Description		26	1291	2600	3000	3400	3810
7001	THM TH01 STI	DGC	19.52	21.47	22.18	21.00	21.00	21.05
7002	THM TH02 SBO	DGC	18.60	20.01	20.55	19.59	19.64	20.10
7003	THM TH03 STI	DGC	18.48	20.28	21.79	20.26	19.57	20.38
7004	THM TH03 SBI	DGC	19.47	20.46	21.11	21.13	20.32	20.29
7005	THM TH04 STI	DGC	18.39	19.81	21.17	19.94	19.05	20.03
7006	THM TH05 SBO	DGC	17.57	18.53	19.04	18.36	17.88	18.50
7007	OA -X THRUSTER	DGC	21.95	23.04	22.38	22.38	22.18	22.98
7008	THM TH07-STO	DGC	15.95	16.87	17.09	16.54	16.16	16.73
7009	THM TH06 SBI	DGC	19.38	20.62	21.05	20.38	19.98	20.53
7010	THM TH07 STI	DGC	18.61	19.71	19.79	19.37	19.15	19.56
7011	THM TH08 STO	DGC	21.78	22.87	22.52	22.49	22.18	22.84
7012	THM TH09 SBI	DGC	21.81	23.07	23.10	22.90	22.67	22.90
7013	THM TH10 SBO	DGC	18.73	19.82	19.87	19.98	19.34	19.58
7014	THM TH11 STI	DGC	22.37	23.62	24.52	24.40	23.62	23.42
7015	THM TH12 SBO	DGC	22.37	23.37	25.36	25.50	23.60	23.10
7016	THM TH13 STI	DGC	20.95	22.68	24.55	24.39	22.83	22.06
7017	RBV BEAM CTR LN	DGC	21.53	22.85	23.30	23.14	22.75	22.68
7018	THM TH14 STO	DGC	20.38	22.10	24.77	24.66	23.03	21.55
7019	NBR RAD OUTBD B4	DGC	5.09	6.08	6.06	5.75	5.58	5.93
7020	THM TH15 SBI	DGC	21.14	23.78	26.21	25.58	24.32	23.30
7021	THM TH16 STI	DGC	20.73	23.68	25.44	24.58	23.71	23.00
7022	THM TH17 SBI	DGC	20.22	23.46	25.18	24.06	23.45	22.68
7023	THM TH18 SBO	DGC	21.90	24.86	25.79	24.56	25.19	24.27
7030	THM TH03 BUR	DGC	16.05	17.09	17.89	16.79	16.25	17.25
7031	THM TH06 BUR	DGC	13.59	14.39	14.49	13.98	13.63	14.25
7032	THM TH09 BUR	DGC	19.92	20.89	20.61	20.67	20.30	20.76
7033	THM TH12 BUR	DGC	21.51	22.49	24.59	24.94	22.74	22.20
7034	THM TH15 BUR	DGC	19.70	22.44	24.36	23.49	23.38	21.80
7035	THM TH18 BUR	DGC	20.11	22.12	22.45	21.22	22.28	21.53
7040	THM TH01 TCB	DGC	19.27	20.80	21.58	20.44	20.57	20.64
7041	THM TH02 TCB	DGC	17.99	19.34	20.00	19.08	18.84	19.44
7042	THM TH03 TCB	DGC	18.34	19.72	21.83	20.24	18.74	20.44
7043	THM TH04 TCB	DGC	18.95	19.93	20.71	19.98	19.32	20.03
7044	THM TH05 TCB	DGC	16.27	17.13	17.45	16.98	16.64	17.07
7045	THM TH07 TCB	DGC	18.41	19.37	19.36	19.01	18.85	19.32
7046	THM TH09 TCB	DGC	19.38	20.60	20.52	20.38	20.17	20.34
7048	THM TH11 TCB	DGC	21.98	23.16	24.32	24.41	23.24	22.99
7049	THM TH12 TCB	DGC	21.92	22.58	25.10	24.95	23.01	22.30
7050	THM TH13 TCB	DGC	21.21	22.51	25.22	25.21	23.19	22.10
7051	THM TH14 TCB	DGC	21.38	23.65	26.19	25.94	24.34	22.92
7052	THM TH16 TCB	DGC	21.30	25.11	26.65	25.17	24.78	24.15
7053	THM TH17 TCB	DGC	21.73	24.81	25.74	24.73	24.84	24.01
7054	THM TH18 TCB	DGC	20.02	22.51	22.99	22.12	22.42	22.16
7060	THM SHUTTER BY 1	DEG	25.85	36.21	43.64	36.66	34.93	34.81
7061	THM SHUTTER BY 2	DEG	6.62	16.89	13.88	13.17	12.76	12.71
7062	THM SHUTTER BY 3	DEG	10.96	25.96	38.14	27.69	21.97	26.69
7063	THM SHUTTER BY 4	DEG	30.60	36.27	38.29	34.97	34.49	37.45
7064	THM SHUTTER BY 5	DEG	15.03	14.42	16.24	15.70	15.63	15.06
7065	THM SHUTTER BY 7	DEG	17.14	20.98	21.92	21.85	21.72	21.45
7067	THM SHUTTER BY 9	DEG	33.26	39.15	38.45	38.44	38.44	38.44
7068	THM SHUTTER BY 10	DEG	24.68	29.54	33.65	33.10	33.04	28.68
7069	THM SHUTTER BY 11	DEG	39.66	48.48	55.79	55.59	50.86	47.84
7070	THM SHUTTER BY 12	DEG	43.81	47.05	55.84	56.11	49.69	46.61
7071	THM SHUTTER BY 13	DEG	40.39	47.96	59.02	58.75	54.68	47.49
7072	THM SHUTTER BY 14	DEG	34.20	42.85	62.55	60.75	48.44	41.92
7073	THM SHUTTER BY 15	DEG	45.40	63.42	75.54	73.25	67.46	60.01
7074	THM SHUTTER BY 16	DEG	24.50	51.25	59.81	56.14	50.58	49.25
7075	THM SHUTTER BY 17	DEG	39.06	60.34	66.93	61.83	60.18	55.10
7076	THM SHUTTER BY 18	DEG	29.70	43.14	48.57	44.54	43.78	42.13
7080	THM Q1 T ZENER V	VDC	8.19	8.19	8.19	8.19	8.19	8.19
7081	THM Q2 T ZENER V	VDC	8.40	8.40	8.40	8.40	8.40	8.40
7082	THM Q3 T ZENER V	VDC	8.31	8.32	8.32	8.31	8.31	8.32
7083	THM Q1 S ZENER V	VDC	8.31	8.35	8.35	8.35	8.33	8.32
7084	THM Q2 S ZENER V	VDC	8.19	8.20	8.21	8.20	8.19	8.19
7085	THM Q3 S ZENER V	VDC	8.15	8.15	8.16	8.15	8.15	8.15
7090	THM PSM MOUNT	DGC	21.60	23.14	23.78	23.47	23.06	22.84
7091	THM IND ATTITUDE	DGC	19.40	20.69	21.07	20.57	20.25	20.66
7092	THM RBV RADIATOR	DGC	15.65	17.31	17.89	17.97	17.13	17.21
7093	THM RBVC CTR BM	DGC	20.30	21.81	22.49	22.30	21.84	21.67
7094	THM WBVTR ROOT	DGC	12.96	15.64	17.10	15.84	15.81	15.49
7095	THM WBVTR RAD CT	DGC	4.81	7.50	8.66	7.39	8.45	7.76
7096	THM WBVTR STRAP	DGC	16.62	19.39	21.06	19.46	19.28	19.02
7097	THM WB MT BAY 1	DGC	20.56	21.59	22.36	19.21	19.72	20.83
7098	THM WB MAT BAY 1	DGC	20.22	21.93	21.05	19.01	19.45	19.82
7099	THM WBVTR SEP 3	DGC	18.60	20.69	22.32	20.66	20.06	20.52
7100	THM WBVTR SEP 17	DGC	21.31	24.41	26.15	24.66	24.09	23.52
7101	THM WBVTR 1 DENT	DGC	21.49	24.19	25.95	24.06	23.64	23.43
7102	THM WBVTR 2 BAY	DGC	17.46	19.07	20.04	19.19	18.56	19.03
7103	THM WBVTR 2 BY 15	DGC	21.00	23.75	25.65	24.92	23.90	23.21
7104	THM WBVTR 2 CTR	DGC	19.35	21.86	23.50	22.35	21.73	21.38
7105	THM NBTR B SEP 6	DGC	18.06	19.71	20.17	19.80	19.51	19.52
7106	THM NBTR B SEP 1	DGC	20.82	22.89	24.88	24.56	23.24	22.47
7107	THM NBTR BM CTR	DGC	19.37	21.34	22.44	21.93	21.34	21.08
7108	THM MSS MOUNT 14	DGC	19.18	21.59	23.89	23.49	22.03	21.33
7109	THM OA -Y THRUSTER	DGC	22.21	24.85	28.11	27.73	25.99	24.17
7110	THM MSS WBVTR BM	DGC	18.14	20.27	21.29	20.85	20.28	20.21
7111	THM OA +X THRUSTER	DGC	20.30	21.82	23.43	19.68	20.43	20.80
7130	THM AVX P1 T	DGC	15.69	14.42	11.23	13.78	21.44	7.28
7131	THM AVX P2 T	DGC	10.63	19.10	3.63	25.84	2.69	20.36

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Table 11-2. Compensation Load History

Orbits	Compensation Loads 1	2	3	4	5	6	7	8
Launch	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	0	0	X	X	X	0	X	X
5	0	0	X	X	X	0	X	X
6	X	X	X	X	X	0	X	X
117	X	X	X	X	X	0	X	X
118	0	0	0	0	0	0	0	0
155	0	0	0	0	0	0	0	0
156	X	X	X	X	X	0	X	X
193	X	X	X	X	X	0	X	X
194	0	0	0	0	0	0	0	0
196	0	0	0	0	0	0	0	0
197	X	X	X	X	X	0	X	X
700	X	X	X	X	X	0	X	X
701	X	X	0	X	X	0	X	X
1409	X	X	0	X	X	0	X	X
1410	X	X	0	X	X	0	0	X
3483	X	X	0	X	X	0	0	X
3484	X	X	X	X	X	0	0	X
3643	X	X	X	X	X	0	0	X
3644	X	X	0	X	X	0	0	X
3645	X	X	0	X	X	0	0	X
3646	X	X	X	X	X	0	0	X
3810	X	X	0	X	X	0	0	X

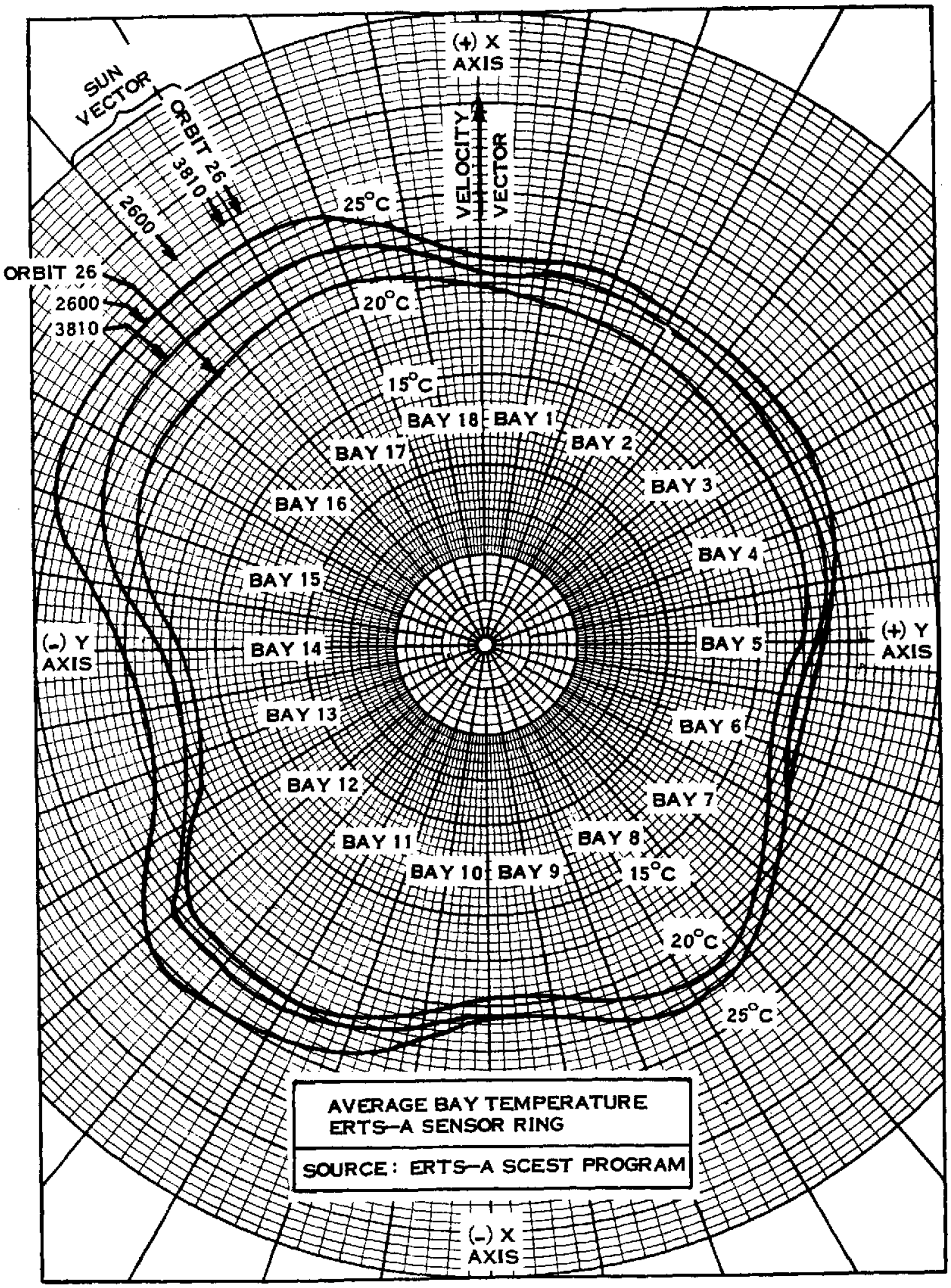

Figure 11-1. Thermal Profile - Orbits 26, 2600, and 3810

SECTION 12

NARROWBAND TAPE RECORDERS

SECTION 12

NARROWBAND TAPE RECORDERS

The Narrowband Tape Recorder Subsystem continued to operate in a completely satisfactory manner. Since Orbit 1, the two recorders A and B have alternated in Record and Playback modes with a nominal one-minute overlap.

Table 12-1 shows typical telemetry values which show normal operation.

Since launch, each recorder has had an ON time of 3342 hours. Each recorder was in the Playback mode for 140 hours in the Record mode for 3202 hours; and in the OFF mode for 3279 hours.

Table 12-2 is a 5% sample showing the performance of the NBTR Subsystem in its entirety, including the radio downlink and the ground station processing. At the end of the table, there is a sample of values from early orbits for comparison.

The second and third columns show the percentage of bad data and missing data at the end of processing. The few high values are attributed to noise on the radio downlink.

The fourth column shows data rate, nominally 24 kilobits, reflecting the speed of the motor during playback. The slightly slower indicated motor speed has no effect on fidelity, but only increases the playback time by less than 1%.

The fifth column shows the standard deviation in the motor speed which would introduce "wow" and "flutter" effects in a major frame. The occasional high values are attributed to noise.

The last column identifies the recorder associated with poorer than normal data for that orbit. Since the two recorders share those orbits, it is concluded the anomalous data are due to noise and not to recorder malfunction.

Table 12-1. Narrowband Tape Recorder Telemetry Values

Function		Typical Telemetry Values			
		*T/V 20°C Plateau	Orbital Values		
Number	Name		6	3750	3751
10001	A - Motor Cur. (ma)				
	Record	198.0	190.10	-	189.20
	P/B	185.0	180.00	190.69	-
10101	B - Motor Cur. (ma)				
	Record	194.0	193.26	193.02	-
	P/B	185.0	188.18	-	185.44
10002	A - Pwr Sup. Cur. (ma)				
	Record	315.0	320.56	-	338.20
	P/B	540.0	535.78	568.38	-
10102	B - Pwr Sup. Cur. (ma)				
	Record	313.0	317.62	336.05	-
	P/B	535.0	570.78	-	555.63
10003	A - Rec. Temp. (DGC)	25.4	25.47	22.90	24.40
10103	B - Rec. Temp. (DGC)	23.8	24.58	20.54	23.41
10004	A - Supply (VDC)	-24.55	-24.47	-24.44	-24.56
10104	B - Supply (VDC)	-24.49	-24.44	-24.51	-24.52

* Thermal Vacuum Test Data

Table 12-2. Narrowband Recorder Subsystem Performance

	% Data		Data Rate		
Orbit	Bad	Missing	Mean	Std Dev.	NBTR*
2750	0.00	0.00	-23.83	0.02	
2751	0.08	0.20	-23.85	0.03	
2752	0.00	0.30	-23.83	0.02	
2753	7.42	0.24	-23.88	3.17	[illegible]
2754	0.01	0.00	-23.83	0.04	
2849	0.01	0.30	-23.83	0.66	
2850	0.00	0.00	-23.85	0.02	
2851	0.00	0.00	-23.83	0.02	
2852	0.00	0.00	-23.85	0.02	
2853	0.00	0.00	-23.83	0.02	
2950	0.04	0.00	-23.85	0.61	
2951	0.01	0.00	-23.83	0.02	
2954	0.00	0.00	-23.87	0.03	
2955	0.00	0.00	-23.85	0.03	
2957	0.00	0.00	-23.87	0.03	
3049	1.21	0.51	-23.85	1.50	A
3052	0.00	0.00	-23.85	0.03	
3053	0.00	0.16	-23.87	0.04	
3054	0.37	0.00	-23.84	0.53	
3055	0.21	0.00	-23.85	0.58	
3150	0.00	0.26	-23.83	0.02	
3152	0.67	0.00	-23.88	2.36	A
3153	0.97	1.06	-23.84	1.60	B
3154	0.56	0.36	-23.85	1.06	
3155	0.00	0.00	-23.83	0.15	
3251	0.24	0.00	-23.85	0.61	A
3252	0.01	0.00	-23.83	0.02	
3253	0.01	0.00	-23.85	0.02	
3254	0.02	0.00	-23.83	2.79	B
3255	0.01	0.00	-23.85	0.02	
3351	0.00	0.00	-23.83	0.02	
3352	0.00	0.00	-23.85	0.02	
3353	0.01	0.00	-23.83	0.02	
3354	0.00	0.00	-23.85	0.02	
3355	0.00	0.00	-23.83	0.02	
3450	0.00	0.26	-23.83	0.02	
3451	0.00	0.24	-23.86	0.02	
3452	0.01	0.00	-23.83	0.02	
3453	0.29	0.26	-23.85	0.86	A
3456	0.00	0.00	-23.85	0.02	
3550	0.00	0.00	-23.83	0.02	
3551	0.00	0.00	-23.86	0.02	
3554	0.00	0.13	-23.85	0.03	
3555	0.14	0.46	-23.87	0.47	A
3556	0.00	0.19	-23.84	0.03	
3657	0.00	0.13	-23.88	0.03	
3651	0.00	0.00	-23.86	0.02	
3652	0.00	0.53	-23.83	0.02	B
3654	0.00	0.00	-23.87	0.03	
3655	0.20	0.00	-23.84	0.55	B
3751	0.00	0.24	-23.86	0.02	
3752	0.00	0.00	-23.84	0.02	
3753	0.00	0.00	-23.86	0.07	
3754	0.01	0.00	-23.83	0.02	
3755	0.00	0.00	-23.86	0.02	

Sample of Prior Orbits

953	0.00	0.00	-23.82	0.02	
1320	0.01	0.00	-23.82	0.03	
1495	0.00	0.00	-23.83	0.02	
1691	0.00	0.00	-23.84	0.03	
1897	0.31	0.00	-23.84	0.03	
2091	0.21	0.23	-23.85	0.57	A
2287	0.19	0.00	-23.85	0.54	A
2496	0.00	0.25	-23.85	0.60	A

*The NBTR is identified for those orbits with high % bad or missing data, or high standard deviation of the data rate.

SECTION 13

WIDEBAND TELEMETRY SUBSYSTEM

SECTION 13

WIDEBAND TELEMETRY SUBSYSTEM

The Wideband Telemetry Subsystem has operated satisfactorily since launch. WPA No. 1 was used with RBV input until Orbit 196. It was used again with MSS input between Orbits 1891 and 2100 because WPA-2 used a frequency too close to those used in the Apollo launch operation. The cumulative ON time was 31 hours, 55 minutes, and 9 seconds. WPA No. 2 has been used since Orbit 20 except for the above interval between Orbits 1891 and 2100. Its cumulative ON time is 408 hours, 4 minutes, and 58 seconds.

Table 13-1 lists typical telemetry values for the Wideband Telemetry Subsystem. All values are normal, and show no deteriorating trends.

Ground Station reports of Wideband Power Amplifier signal strength continue to show no significant decline with time. Stations using 30-foot antennas customarily obtain AGC readings of about -76 dbm with the spacecraft overhead. At 2600 kilometers slant range, the AGC readings are about -82 dbm.

Table 13-1. Wideband Modulator Telemetry Values

WBPA-1 Function Number	Name		T/V* Values	Orbits 26	1849	1944	2095
12001	Temp TWT Coll.	(DgC)	38.7	35.7	39.20	39.90	39.90
12002	Helix Current	(Ma)	6.47	6.08	6.49	6.58	6.78
12003	TWT Cath. Cur.	(Ma)	45.4	45.89	43.54	43.48	45.01
12004	Forward Pwr	(DBM)	43.2	43.18	42.88	42.61	43.15
12005	Reflected Pwr	(DBM)	32.4	34.95	34.99	34.80	35.21
12227	Loop Str. AFC ConVolt	(MHZ)	(1)	-0.39	-1.26	-0.86	-0.67
12229	Mod Temp VCO	(DgC)	24.4	21.93	20.31	20.88	20.39
12232	+15VDC A(3) Pwr Sup (3)	(TMV)	2.69	2.69	2.69	2.65	2.62
12234	-15 VDC Pwr Sup A	(TMV)	5.91	5.98	5.96	5.73	5.78
12236	+5 VDC Pwr Sup A	(TMV)	4.01	3.94	3.94	3.94	3.95
12238	-5 VDC Pwr Sup A	(TMV)	5.26	5.28	5.26	5.18	5.12
12240	-24 VDC Unreg Volt A	(TMV)	5.42	5.56	5.51	5.42	5.49
12242	Inv. Temp	(DgC)	24.5	20.60	23.43	24.71	24.04

WBPA-2 Function Number	Name		T/V* (2) Values	33	3000	3400	3810
12101	Temp TWT Coll.	(DgC)	31.5	35.38	36.17	37.21	36.02
12102	Helix Current	(Ma)	5.26	7.32	7.67	7.58	7.52
12103	TWT Cath. Cur.	(Ma)	33.5	44.30	42.95	43.94	42.47
12104	Forward Pwr	(DBM)	41.2	43.57	43.55	43.58	43.34
12105	Reflected Pwr	(DBM)	30.6	31.59	32.68	33.24	32.46
12228	Loop Str HFC ConVolt	(MHZ)	(1)	1.11	-0.55	-0.18	-0.33
12229	Mod Temp VCO	(DgC)	24.4	21.70	21.63	20.00	21.39
12232	+15 VDC A(3) Pwr Sup	(TMV)	2.67	2.68	2.67	2.68	2.67
12234	-15 VDC Pwr Sup A	(TMV)	5.95	5.90	5.92	5.98	5.79
12236	+5 VDC Pwr Sup A	(TMV)	4.01	3.97	4.01	4.02	3.97
12238	-5 VDC Pwr Sup A	(TMV)	5.26	5.24	5.26	5.24	5.11
12240	-24.5 VDC Unreg Volt A	(TMV)	5.42	5.43	5.51	5.64	5.51
12242	Inv. Temp	(DgC)	24.5	23.03	22.89	22.44	23.03

*Thermal Vacuum Test Data

(1) Satisfactory if not zero or -7.5.

(2) Tested T/V in 10-watt mode; put in 20-watt mode in Orbit 30 and used in that mode since. Thermal vacuum values not representative for orbital operation, therefore.

(3) B Power Supply not used in orbit.

SECTION 14

ATTITUDE MEASUREMENT SENSOR

SECTION 14

ATTITUDE MEASUREMENT SENSOR

The AMS has consistently produced attitude values which seem reasonable. Since no direct precise correlation can be made with the Attitude Control System the AMS values are accepted. Effort is continuing to refine techniques to evaluate AMS performance. The AMS sensor is functioning properly. Appendix E, ERTS-1 Attitude and Rate Histograms, gives the results of some AMS telemetry values.

Table 14-1 gives typical AMS telemetry values.

Table 14-1. AMS Temperature Telemetry Summary

Function No.	Name	Units	*T/V 20°C Plateau	Orbit			
				35	3000	3400	3810
3004	Case - Temp 1	°C	19.1	18.92	19.72	19.58	19.62
3005	Assembly - Temp 2	°C	18.9	19.15	20.00	19.95	19.97

*Thermal Vacuum Test Data

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS

SECTION 15

WIDEBAND VIDEO TAPE RECORDERS

The Wideband Video Tape Recorder Subsystem consists of two components WBVTR-1 and WBVTR-2.

WBVTR-2 failed in Orbit 148 after 9 hours, 26 minutes and 33 seconds of satisfactory flight performance.

WBVTR-1 has operated satisfactorily since turn-on in Orbit 26. Its cumulative flight ON time through Orbit 3810 has been 547 hours, 34 minutes and 55 seconds. Of this time, the video head was in contact with the moving tape for 429 hours, 35 minutes and 22 seconds. Combined with the pre-flight contact time of 126 hours, the total contact time has been 555:35:22.

After passing 500 hours of head contact time in Orbit 3089, the WBVTR-1 operated normally until Orbit 3201 when the head wheel current began a climb from about 675 ma. to 850 ma. in Orbit 3205 after which it slowly declines over the next hundred orbits to about 700 ma. Meanwhile MFSE counts showed only one abnormality, when in Orbit 3210 while playing back data from Orbit 3202, the MFSE count rose above 24,000 for 90 seconds. It then abruptly dropped below ten for the remainder of Orbit 3210 and for subsequent orbits. During playback in Orbit 3463 the WBVTR-1 experienced a severe anomaly (See Appendix B) where the MFSE counts were in the thousands. After Orbit 3467, with the MFSE counts still in the hundreds, operation of the WBVTR-1 was suspended while the anomaly was studied.

From Orbits 3649 to 3787, record and playback sessions of 5 to 8 scenes were performed daily to observe the WBVTR performance and the quality of the resulting data. In general, the performanc was good and the data completely usable. See Appendix B.

Between Orbits 3788 and 3810, two 3-minute recordings and one 3-minute playback was made on the tape footages between 1147 and 1480. The MFSE counts were below 50 and the headwheel current below 600 ma. The data was completely usable.

The study of performance and quality continued.

Table 15-1 lists typical pre- and post-anomaly telemetry. The telemetry values for WBVTR-2 are also shown in this table for completeness and convenience.

Table 15-2 shows typical telemetry values for the indicated functions in each operational mode--Standby, Record, Rewind and Playback.

Table 15-1. WBVTR Telemetry Values

WBVTR-1 Functions			Telemetry Values In Orbits			
Number	Name	T/V*	15	3000	3398	3792
13022	Pressure Trans (PSI)	16.3	16.12	16.19	16.27	15.99
13023	Temp Trans (DgC)	22.0	19.50	24.73	23.66	23.82
13024	Temp Elec (DgC)	28.7	22.78	28.47	29.43	27.84
13026	Capstan Speed (%)	98.0	100.51	99.78	100.15	101.03
13027	Headwheel Speed (%)	99.6	95.16	92.72	92.98	93.60
13028	Capstan Mot I (Amp)	0.24	0.25	0.23	0.23	0.26
13029	Input P/B Volt. (VVP)	(2) 0.76	0.72	0.40	0.40	0.59
13030	Headwheel Mot I (Amp)	0.55	0.55	0.55	0.64	0.56
13031	Rec Input I (Amp)	3.55	3.15	3.03	3.36	3.15
13032	Lim Volt Out (VPP)	1.48	1.44	1.43	1.42	1.37
13033	Servo Volt (%)	50.0	50.03	50.42	50.31	50.10
13034	+5.6 VDC Conv (VDC)	5.66	5.66	5.65	5.73	5.74
13200	-24.5 VDC (VDC)	(1)	-24.91	-24.90	-24.91	-24.91
13201	-12 VDC (VDC)	(1)	-12.08	-12.08	-12.08	-12.08
13202	Temp APU (DgC)	(1)	25.79	28.41	27.46	26.77
WBVTR-2 Functions			**Orbit Number**			
Number	Name	T/V*	15	64	103	147
13122	Pressure, Trans (PSI)	(3)	15.99	16.25	16.25	16.11
13123	Temp Trans (DgC)		18.46	19.19	20.72	21.09
13124	Temp Elec (DgC)		21.50	22.00	24.00	21.92
13126	Capstan Speed (%)		99.91	100.53	100.80	99.38
13127	Headwheel Speed (%)		94.16	95.48	97.64	98.78
13128	Capstan Mot I (Amp)		0.17	0.24	0.24	0.28
13129	Input P/B Volt. (VPP)		0.66	0.63	0.62	0.61
13130	Headwheel Mot I (Amp)		0.55	0.59	0.52	0.53
13131	Rec Input I (Amp)		3.70	3.53	3.07	3.43
13132	Lim Volt. Out (VPP)		1.34	1.41	1.41	1.39
13133	Servo Volt (%)		49.47	49.60	49.80	49.48
13134	+5.6 VDC (VDC)		5.47	5.64	5.58	5.59
13200	-24.5 VDC (VDC)		-24.91	-24.90	-24.90	-24.90
13201	-12 VDC (VDC)		-12.08	-12.08	-12.08	-12.09
13202	Temp APU (DgC)		25.79	26.31	27.64	26.19

*Thermal Vacuum Test Data

(1) Thermal VacValues not given

(2) After Orbit 196 WBVTR-1 configured to MSS: Thermo Vac Value then 0.40.

(3) Thermal Vacuum Data are not available for WBVTR-2.

Table 15-2. Function Values by Mode in Orbit

Function/Description	Playback		Standby		Rewind		Record	
	T/V	Orbit 3781	T/V	Orbit 3750	T/V	Orbit 3778	T/V	Orbit 3791
13029 - Input P/B Voltage	0.37	0.58	0	0	0	0	0	0
13028 - Capstan Motor Current	0.25	0.26	0	0	0.18	0.20	0.28	0.26
13030 - Head Wheel Motor Current	0.56	0.62	0.45	0.44	0.50	0.46	0.55	0.58
13031 - Recorder Input Current	3.27	3.74	2.04	1.78	2.16	2.07	3.55	3.46
13033 - Serval Voltage	50.0	50.7	0	0	0	0	0	0
13026 - Capstan Motor Speed	98.0	101.3	0	0	102.20	99.20	99.60	102.88
13027 - Head Wheel Motor Speed	99.7	93.64	103.10	95.41	101.90	95.10	99.60	194.23

SECTION 16

RETURN BEAM VIDICON SYSTEM

SECTION 16
RETURN BEAM VIDICON

The Return Beam Vidicon (RBV) Subsystem operated normally from turn-on in Orbit 19 to Orbit 196 when it failed to respond to a turn-off command because of a probable failure of a relay in the Power Switching Module. The RBV itself was not the cause of the failure, nor was it affected by the failure. The RBV has not been reactivated since Orbit 196.

An assessment of the RBV performance was given in ERTS-1 Flight Evaluation Report 23 July to 23 October 1972. For completeness and convenience, the telemetry values are repeated in Table 16-1.

Table 16-1. RBV Telemetry Values

FUNCTION		ORBITS				
NO.	NAME	T/V VALUE	26	85	149	196
14001	CCC Board Temp. (DgC)	(1)	18.61	20.04	19.30	19.53
14002	CCC Pwr. Sup. Temp (DgC)	(1)	19.93	21.58	20.70	21.21
14003	±15 VDC Sup. (TMV)	3.95	3.69	3.95	3.78	3.95
14004	∓6V-5.25 VDC Sup. (TMV)	3.05	2.84	2.93	2.98	3.05
14100	VID OUT CAM 1 (TMV)	1.06	1.04	1.15	1.13	1.12
14200	VID OUT CAM 2 (TMV)	1.09	1.05	1.26	1.23	1.24
14300	VID OUT CAM 3 (TMV)	1.05	1.03	1.21	1.19	1.20
14102	Comb. Align I Com 1 (TMV)	3.95	3.67	3.94	3.87	3.94
14202	Comb. Align I Com 2 (TMV)	3.92	3.90	3.91	3.89	3.91
14302	Comb. Align I Com 3 (TMV)	4.04	3.75	4.03	3.80	4.03
14103	Cam 1 Elec Temp. (DgC)	(1)	20.84	23.37	22.64	25.38
14203	Cam 2 Elec Temp. (DgC)	(1)	18.64	21.06	20.62	22.87
14303	Cam 3 Elec Temp. (DgC)	(1)	21.05	23.61	23.23	25.57
14104	Cam 1 LV Pwr Sup T. (DgC)	(1)	21.71	23.94	23.49	25.92
14204	Cam 2 LV Pwr Sup T. (DgC)	(1)	18.38	20.63	19.40	23.30
14304	Cam 3 LV Pwr Sup T. (DgC)	(1)	20.75	23.02	22.73	25.67
14105	Cam 1 Def. + 10 VDC (TMV)	4.01	3.73	4.00	3.77	4.00
14205	Cam 2 Def. + 10 VDC (TMV)	4.00	3.71	3.98	3.77	3.98
14305	Cam 3 Def. + 10 VDC (TMV)	3.97	3.95	3.95	4.02	3.95
14106	Cam 1 + 6V -6.3 VDC (TMV)	3.71	3.45	3.70	3.61	3.70
14206	Cam 2 + 6V -6.3 VDC (TMV)	3.69	3.42	3.67	3.49	3.67
14306	Cam 3 +6V -6.3 VDC (TMV)	3.73	3.47	3.72	3.47	3.72
14107	Cam 1 Telec I (TMV)	2.62	2.50	2.54	2.55	2.64
14207	Cam 2 Telec I (TMV)	2.65	2.53	2.56	2.41	2.64
14307	Cam 3 Telec I (TMV)	2.64	2.54	2.51	2.45	2.61
14108	Cam 1 Vid Fil I (TMV)	2.47	2.30	2.36	2.38	2.46
14208	Cam 2 Vid Fil I (TMV)	2.54	2.37	2.52	2.39	2.52
14308	Cam 3 Vid Fil I (TMV)	2.61	2.44	2.60	2.53	2.60
14110	Cam 1 TARVOLT (TMV)	3.43	3.42	3.42	3.45	3.42
14210	Cam 2 TARVOLT (TMV)	3.36	3.13	3.22	3.26	3.32
14310	Cam 3 TARVOLT (TMV)	3.47	3.23	3.46	3.45	3.47
14113	Cam 1 Vert Def V (TMV)	2.96	2.75	2.90	2.85	2.97
14213	Cam 2 Vert Def V (TMV)	3.00	2.86	2.98	2.86	3.01
14313	Cam 3 Vert Def V (TMV)	3.45	3.45	3.47	3.37	3.45
14114	Cam 1 Vid FPT (DgC)	(1)	18.15	20.77	17.91	20.99
14214	Cam 2 Vid FPT (DgC)	(1)	20.62	20.11	20.52	20.62
14314	Cam 3 Vid FPT (DgC)	(1)	18.54	20.88	19.08	20.20
14115	Cam 1 Foc Coil T (DgC)	(1)	17.71	21.67	18.74	19.70
14215	Cam 2 Foc Coil T (DgC)	(1)	17.70	21.60	19.25	19.97
14315	Cam 3 Foc Coil T (DgC)	(1)	18.03	22.09	19.88	20.56

(1) Thermo-Vacuum temperatures for these functions were not reported.

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM

SECTION 17

MULTISPECTRAL SCANNER SUBSYSTEM

The Multispectral Scanner Subsystem (MSS) continued to operate satisfactorily.

Telemetry values have been within normal limits since launch. Table 17-1 shows typical readings. The maximum multiplexer temperature to date is $31^{\circ}C$. The calibration lamp A current has remained at 1.12 TMV from pre-launch to the present.

Line length words were found to remain within the 3220 $\pm$ 3 word criteria. Figure 17-1 shows the line length history since launch. The line length words were checked from the RSE test set interval lights during real time data transmission.

Minor Frame Sync Error counts have been normal (zero) during all real-time data transmissions.

Time code extracted from demuxed data was observed and found to be functioning normally.

Noise characteristics at black level video exhibited no excessive noise in any of the 24 video channels.

Rotating shutter lock was checked and found to be a nominal 35 to 40 seconds, which is normal for this scanner.

Real time data is routinely observed on the A-scope during real time transmission and data quality appears to be uniformly good.

All Band 1 cal wedges are still out of saturation, but continue to remain stable.

To determine whether quantum levels remain stable with time, a comparison was made between five words on the calibration wedge in each sensor as seen in Orbits 1240 and 3159.

Table 17-1. MSS Telemetry Values

Function No.	Name	Unit	T/V Val *	Orbit 20	3001	3400	3810
15044	FOPT 2 T	(DGC)	20.5	17.46	20.80	20.21	20.25
15046	ELEC CVR T	(DGC)	21.5	19.37	22.68	22.06	22.26
15048	SCAN MIR REG T	(DGC)	22.8	16.35	21.50	20.36	20.63
15050	SCAN MIR DR. COIL T	(DGC)	22.4	15.94	20.99	20.01	20.10
15052	ROT SHUT HSG T	(DGC)	20.8	16.91	20.68	20.13	20.28
15043	FOPT 1 T	(DGC)	20.6	17.67	20.96	20.40	20.42
15045	MUX PWR CASE T	(DGC)	22.4	21.19	23.90	22.77	23.04
15047	PWR SUP T	(DGC)	21.6	17.41	21.09	20.40	20.65
15049	SCAN MIR DR. ELC T	(DGC)	22.8	16.12	21.16	20.07	20.35
15051	SCAN MIR HSG T	(DGC)	21.1	15.60	20.71	19.62	19.67
15040	MUX -6 VDC	(TMV)	3.95	4.03	4.03	4.03	4.03
15042	AVG DENS DATA	(TMV)	1.76	1.67	2.13	2.20	2.35
15054	CAL LAMP CUR A	(TMV)	1.06	1.12	1.12	1.12	1.12
15056	BAND 2 ± 15 VDC	(TMV)	5.05	5.10	5.10	5.10	5.10
15058	BAND 4 ± 15 VDC	(TMV)	5.00	5.10	5.10	5.10	5.10
15060	+12 - 6 VDC REG	(TMV)	4.90	4.82	5.02	4.86	5.02
15062	+19 VDC REC OUT	(TMV)	4.81	4.80	5.01	4.85	5.00
15064	BAND 1 HV A	(TMV)	5.21	5.10	5.12	5.12	5.12
15066	BAND 2 HV A	(TMV)	4.46	4.50	4.52	4.52	4.50
15068	BAND 3 HV A	(TMV)	4.58	4.60	4.62	4.62	4.62
15070	SHUT MOT CON OUT	(TMV)	2.46	2.43	2.51	2.43	2.52
15041	A/D CONV REF V	(TMV)	5.82	5.93	5.95	5.93	5.93
15053	SCAN MIR REG V	(TMV)	4.44	4.42	4.63	4.48	4.61
15055	BAND 1 ± 15V	(TMV)	4.94	4.97	4.97	4.97	4.97
15057	BAND 3 ± 15V	(TMV)	4.94	5.00	5.00	5.00	5.00
15059	-15 VDC TEL.	(TMV)	5.02	5.02	5.02	5.02	5.02
15061	± 5 VDC LOGIC REG	(TMV)	4.80	4.82	4.77	4.81	4.75
15063	-19 VDC REG OUT	(TMV)	3.42	3.43	3.57	3.45	3.50
15071	SCAN MIR DR. CLK	(TMV)	1.94	1.93	2.00	1.95	2.00

* THERMAL VACUUM TEST DATA

(HV SUPPLY B NOT USED YET IN ORBIT)

The comparison for only one word is shown in Table 17-2, and is typical for all 5 words. The stability is apparent. A comparison of the slope and offset of each sensor calibration wedge between Orbits 1240 and 3159 are presented in quantum levels in Table 17-3. The slopes shown in Table 17-3 are relative to a standard slope, and show acceptable correlation. The offset correlation is also good.

Table 17-2. Quantum Level Stability

Word No.	Sensor No.	Orbit 1240	Orbit 3159
280	1	41.18	41.96
	2	41.87	42.10
	3	40.20	41.02
	4	40.55	40.70
	5	39.08	38.12
	6	42.09	43.16
380	7	47.32	47.58
	8	46.02	44.98
	9	47.35	47.06
	10	46.72	44.95
	11	47.21	46.91
	12	46.55	46.29
360	13	49.77	51.04
	14	46.65	46.12
	15	47.75	46.76
	16	42.72	40.99
	17	43.99	43.23
	18	45.15	44.13
250	19	40.23	40.35
	20	37.31	37.09
	21	39.48	39.83
	22	33.28	33.36
	23	32.67	33.37
	24	33.66	34.53

Table 17-3. Slope and Offset

Sensor	Relative Slope		Offset	
	Orbit 1240	Orbit 3159	Orbit 1240	Orbit 3159
1	+0.049	+0.029	-2.26	-2.33
2	+0.078	+0.077	-3.47	-3.66
3	+0.010	+0.005	-2.62	-2.87
4	+0.074	+0.069	-2.15	-2.06
5	+0.045	+0.070	-2.41	-2.22
6	-0.044	-0.068	-3.31	-3.56
7	+0.128	+0.123	-7.99	-7.95
8	+0.122	+0.138	-6.83	-6.49
9	+0.086	+0.090	-6.56	-6.42
10	+0.079	+0.108	-7.28	-6.76
11	+0.052	+0.056	-6.28	-6.12
12	+0.032	+0.037	-6.39	-6.34
13	-0.109	-0.137	-7.54	-7.84
14	-0.074	-0.065	-6.52	-6.33
15	-0.137	-0.121	-6.35	-5.94
16	-0.136	-0.116	-5.62	-4.84
17	-0.153	-0.140	-5.71	-5.42
18	-0.072	-0.055	-5.61	-5.29
19	-0.397	-0.402	+2.43	+2.50
20	-0.453	-0.445	+2.67	+2.69
21	-0.486	-0.503	+3.50	+3.62
22	-0.462	-0.468	+2.89	+2.97
23	-0.455	-0.485	+2.22	+2.30
24	-0.318	-0.354	+2.30	+2.40

To compare the cal wedge word quantum level versus orbit, only one word from the calibration wedge in each sensor has been selected for graph presentation. However, the other five words selected in the computer program to determine the wedge shaping have been analyzed and found to be consistent with the data presented in Figures 17-2 to 17-9. Sensors 1 thru 7 plus 9, 11 and 12 all reveal that a gradual decrease was occurring from initial activation to $\approx$ Orbit 1000 and has remained somewhat stable from Orbit 1000 to present. This characteristic has also been witnessed by oscilloscope as all of the Band 1 calibration wedges have come out of saturation since initial activation. The other sensors show an early rise before the decline and levelling off seen in all the sensors.

All sun calibration pulse amplitude data on Figures 17-10 and 17-11 have been taken from scope readings with the MSS in the primary/low/linear mode or the MSS in the primary/low/compressed mode. MSS data in the primary/low/compressed mode has been transformed to primary/low/linear in order to present consistent parameters for graphing.

The sun cal input is obtained through a series of four mirrors (facets) any one or two facets may be activated during a single sun cal orbit depending on the spacecraft attitude, rates, and time of year. With a stable vehicle (Nadir reference) the pulse duration would be about 9.3 seconds and the input of consecutive pulses for any orbit would be separated by $\approx$ 1 minute 11 seconds.

During sun calibration input the vehicle has been noted to be reacquiring horizon reference at the terminator. This indicates a yaw change away from the sun and pitch down during some sun cal inputs and pitch up during other sun cal inputs, however, this should have no effect on the peak sun cal pulse.

Before launch the expected sun cal output from the four MSS bands was:

Band 1 - 2.8 volts

Band 2 - 3.0 volts

Band 3 - 2.6 volts

Band 4 - 2.0 volts

A typical reading for sun calibrations acquired in Orbit is that taken at NASA OCC during Orbit 3742 on April 18, 1973. Only one mirror facet was active. The sun was in the field of view for 25 seconds with the pulse occurring at 22 milliseconds from line start. Sun calibration pulse maximum amplitude, via scope, for each channel in primary/low/compression mode is shown in Table 17-4. These values, less than those expected before launch, have remained stable since launch. The explanation for the difference is still under study. Thirty-six MSS sun calibrations were made. The orbits are listed in Table 17-5.

Table 17-5. MSS Sun Calibration Orbits

21	730	1790	2766
47	814	1887	2964
89	915	1985	3159
103	1012	2082	3351
131	1207	2180	3546
214	1303	2278	3742
326	1400	2375	
423	1497	2389	
521	1595	2473	
619	1692	2585	

Table 17-4. Sun-Cal Pulse Values for Orbit 3742

Sensor No.	(Volts)
1	0.8
2	0.8
3	0.8
4	0.7
5	0.7
6	0.8
7	2.0
8	1.8
9	2.0
10	2.0
11	2.0
12	2.0
13	2.8
14	2.6
15	2.6
16	2.4
17	2.6
18	2.4
19	1.8
20	1.7
21	1.8
22	1.7
23	1.8
24	1.7

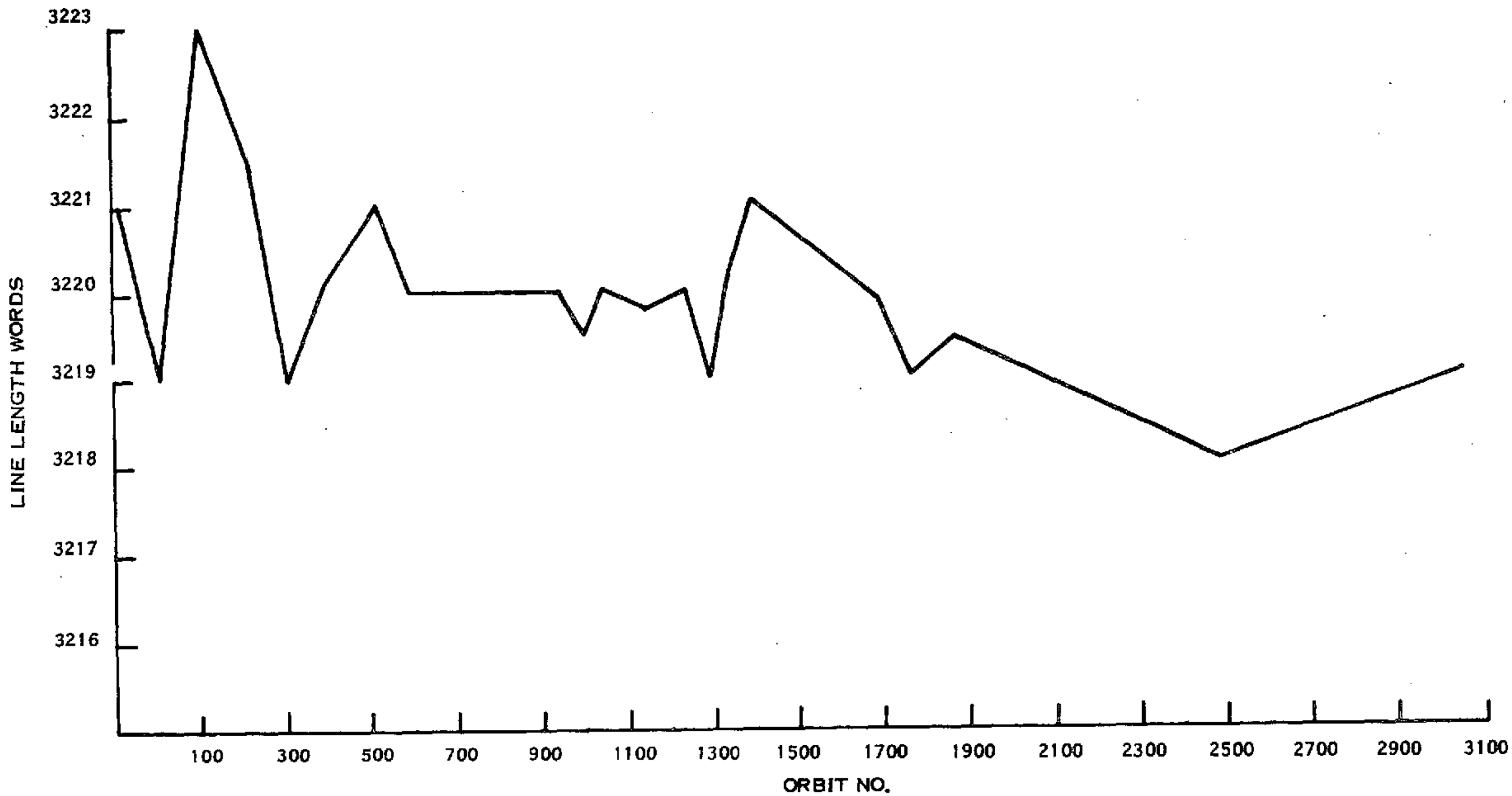

Figure 17-1. Line Length vs. Orbit

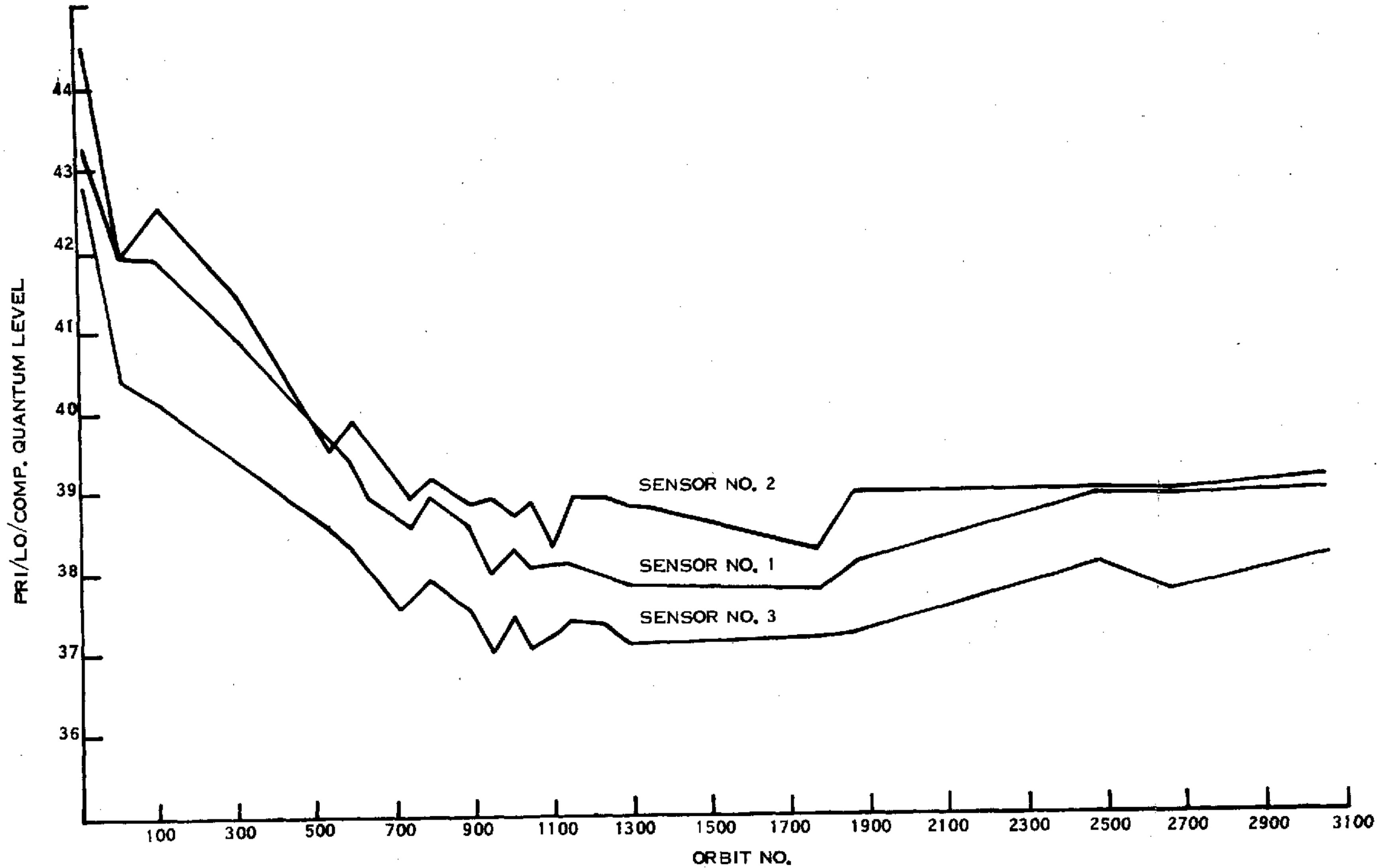

Figure 17-2. Band #1 Quantum vs. Orbit, Word #300

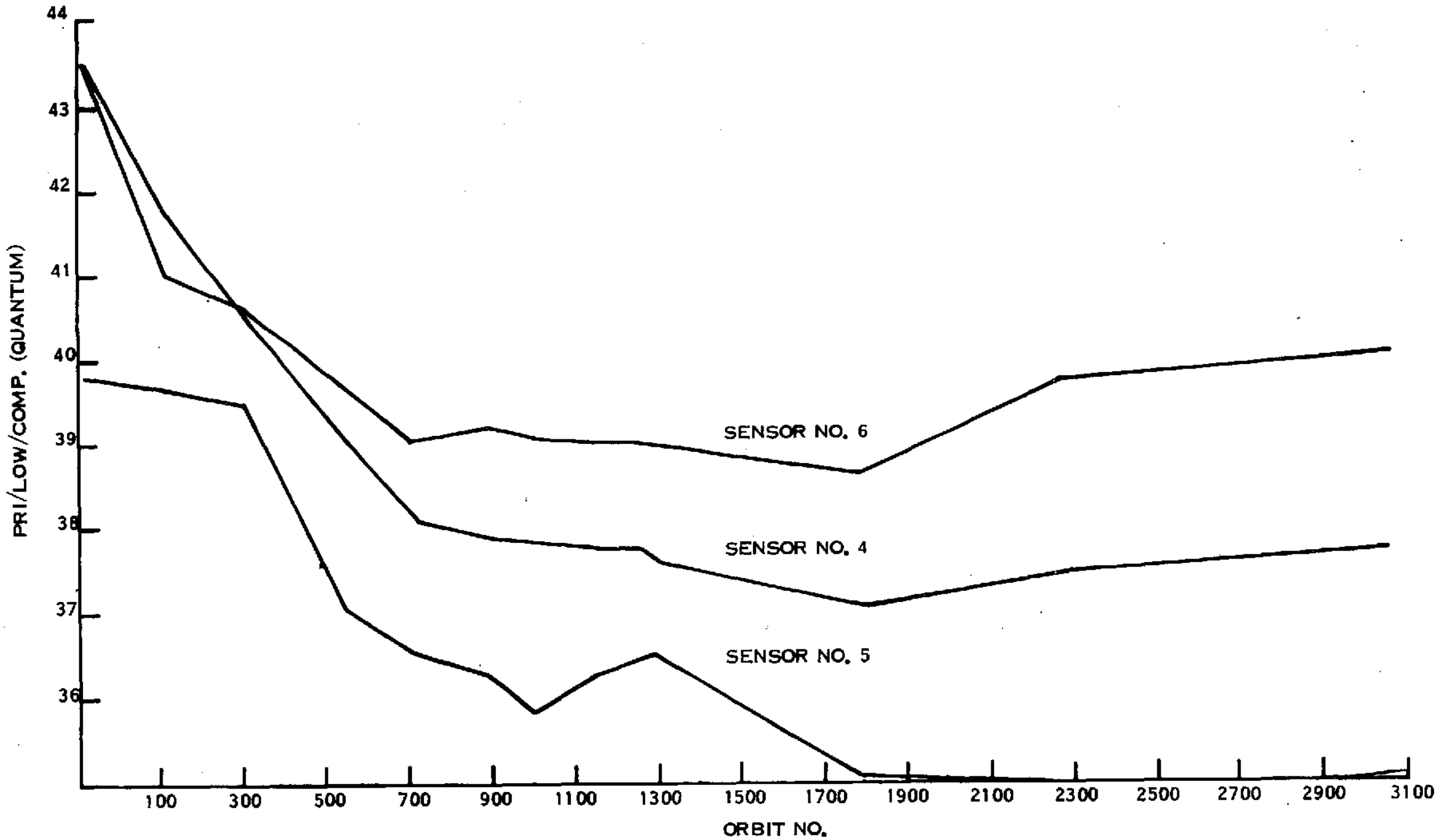

Figure 17-3. Band #1 Quantum vs. Orbit, Word #300

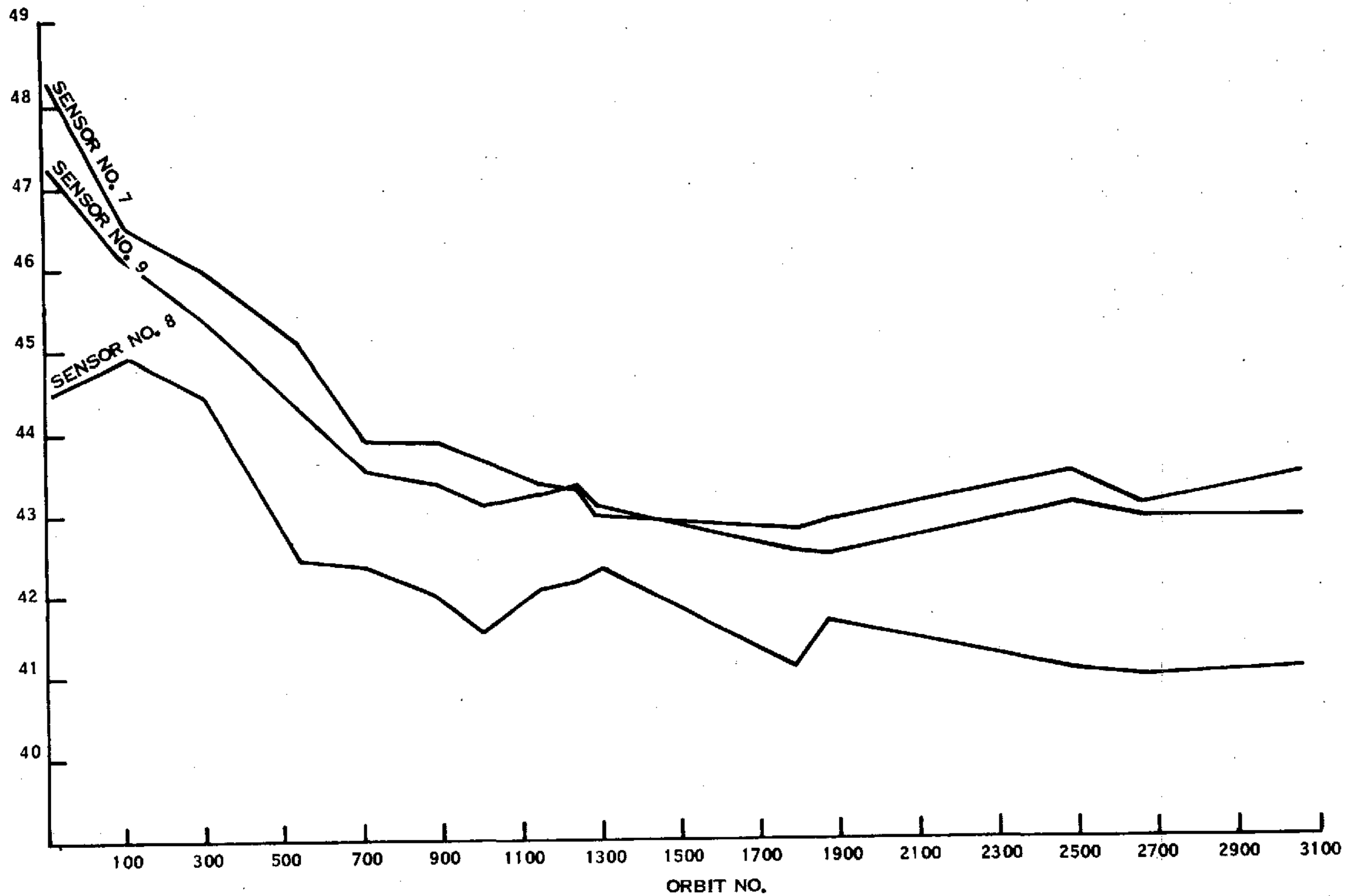

Figure 17-4. Band #2 Quantum vs. Orbit, Word #410

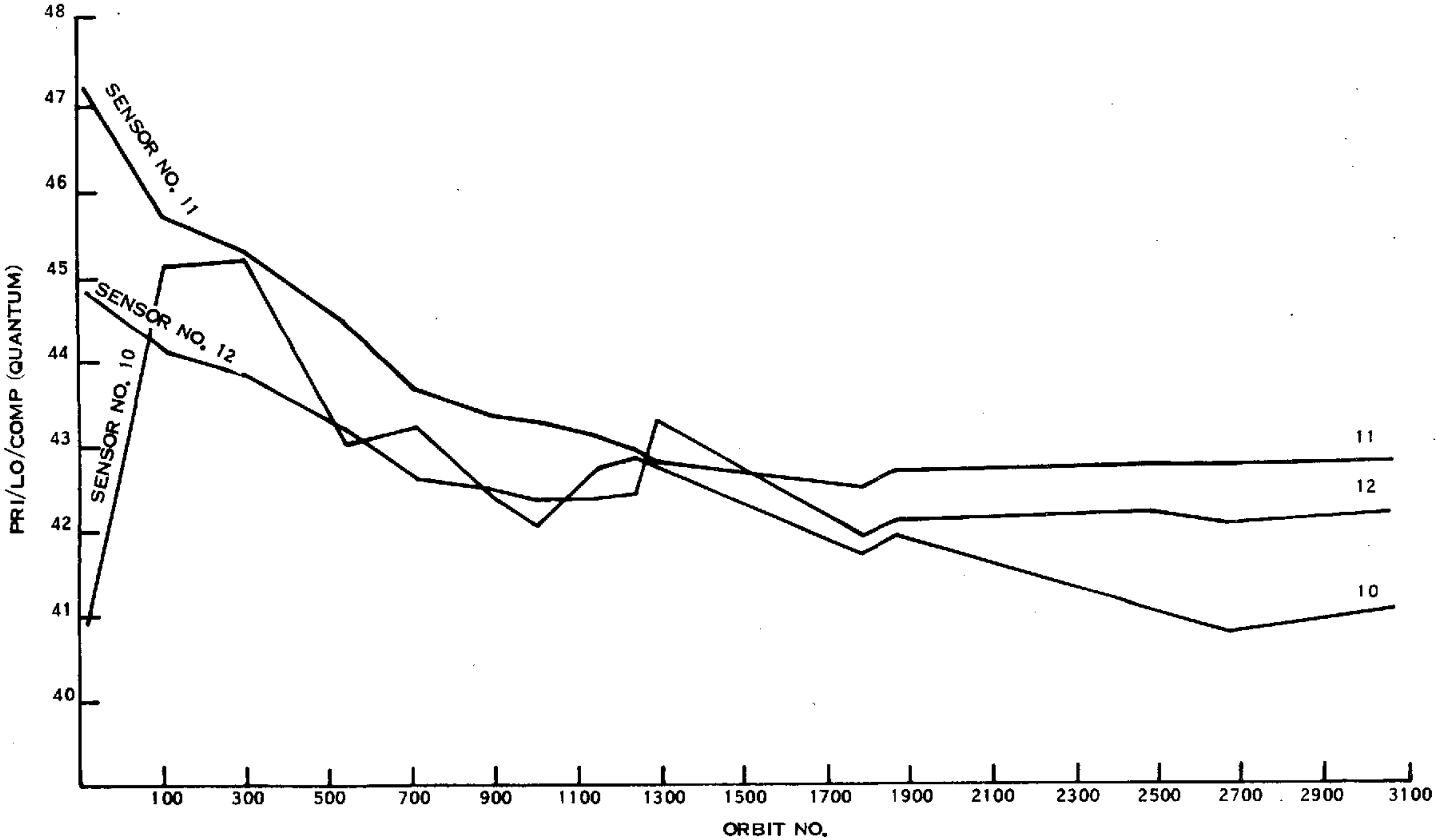

Figure 17-5. Band #2 Quantum vs. Orbit, Word #410

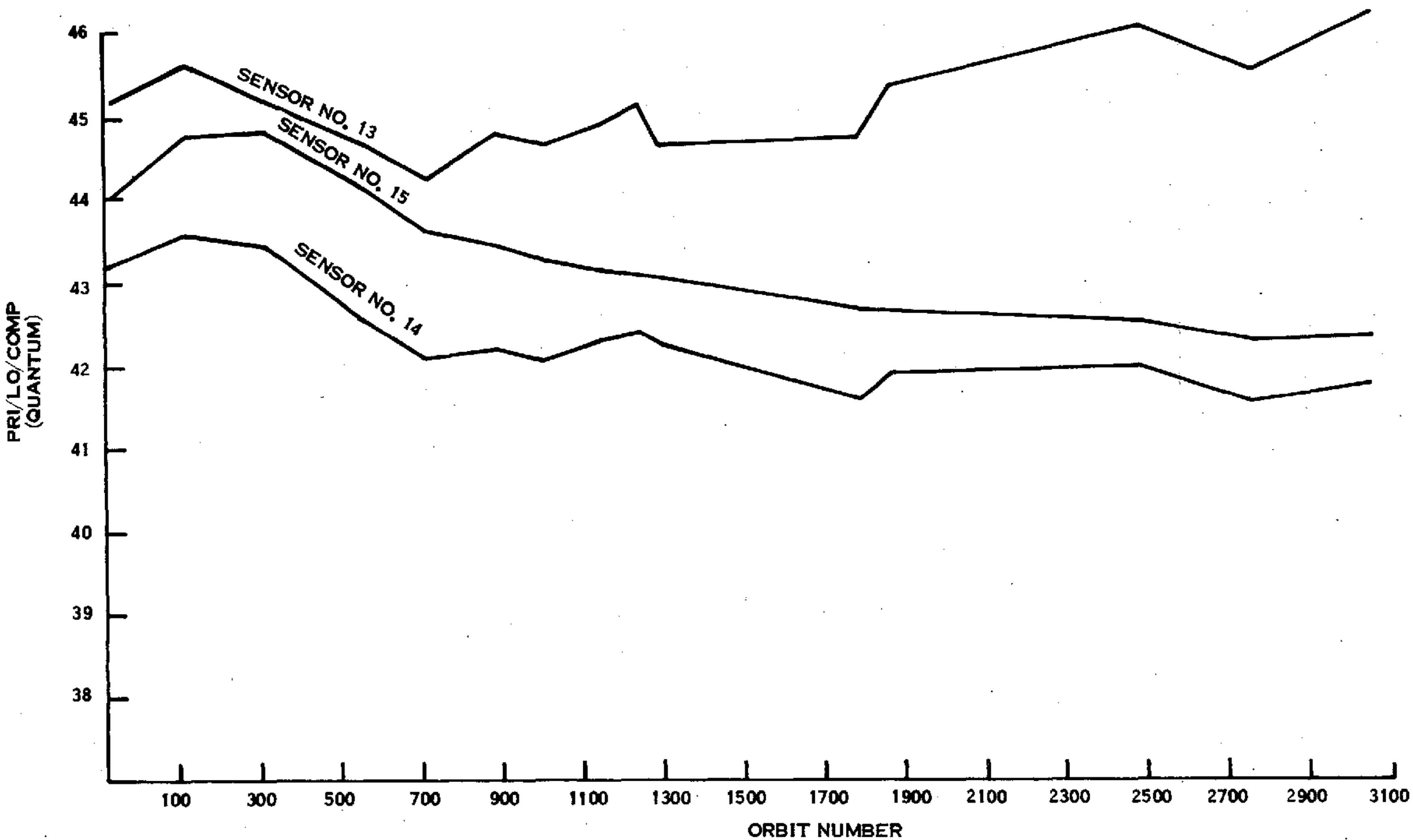

Figure 17-6. Band #3 Quantum vs. Orbit, Word #410

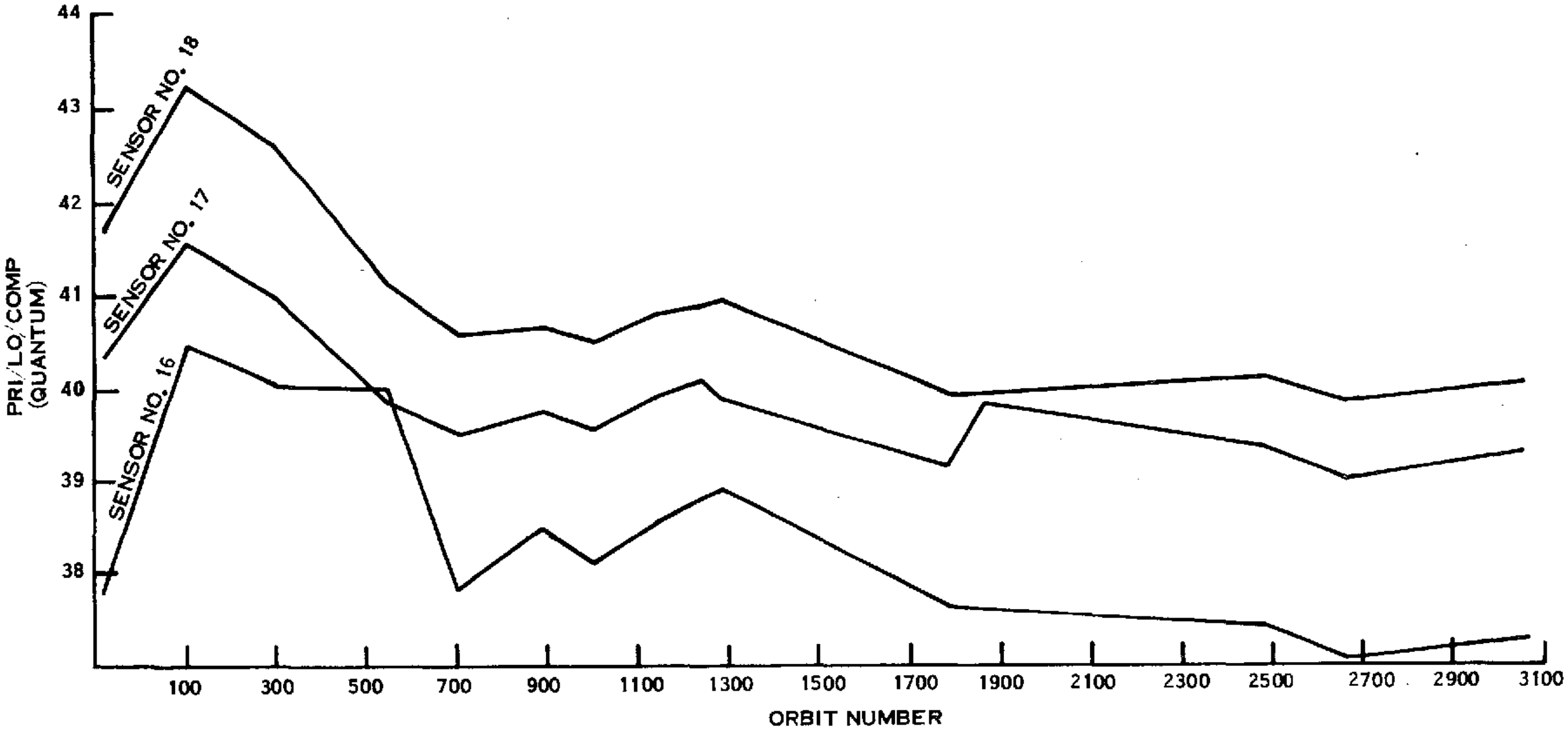

Figure 17-7. Band #3 Quantum vs. Orbit, Word #410

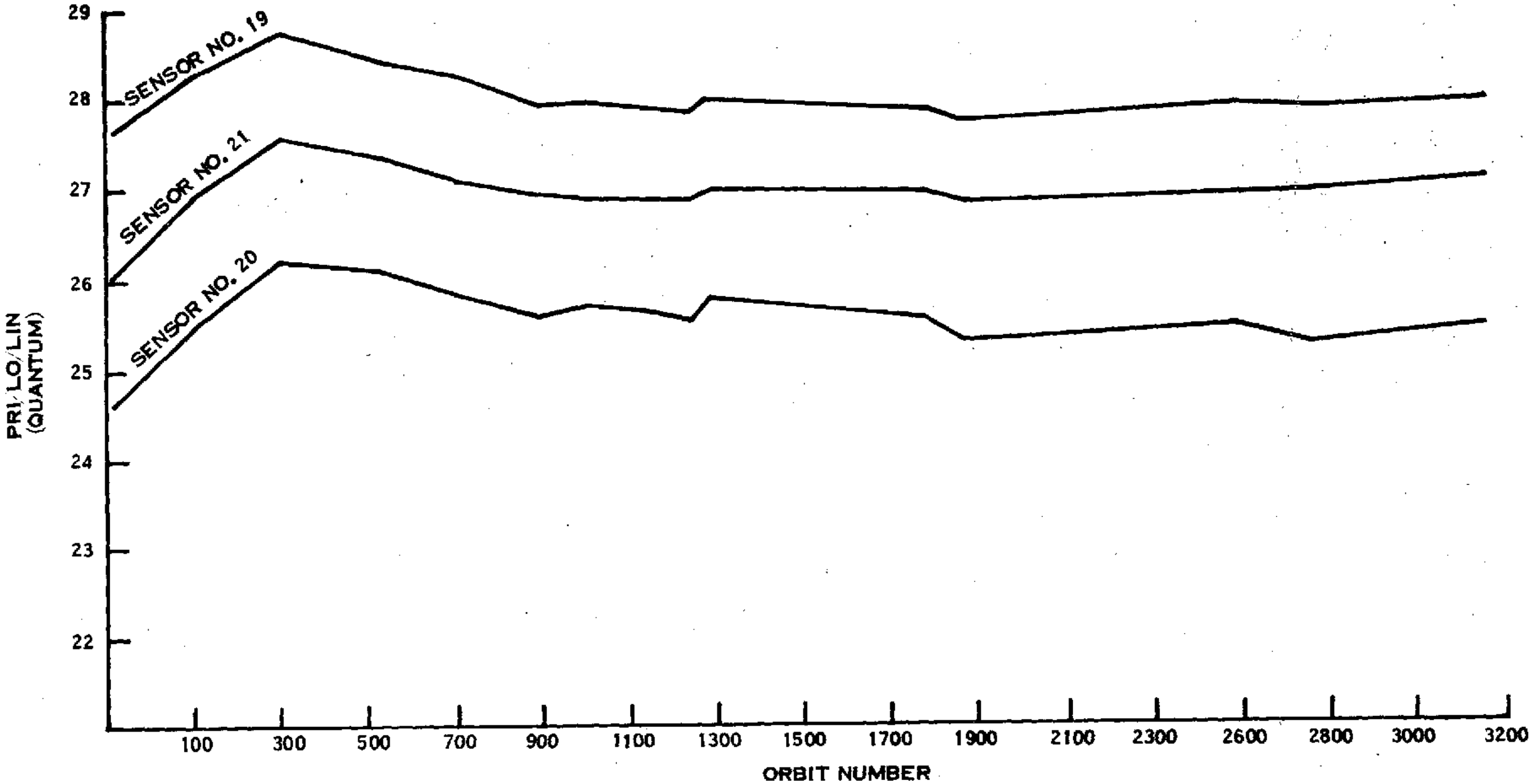

Figure 17-8. Band #4 Quantum vs. Orbit, Word #270

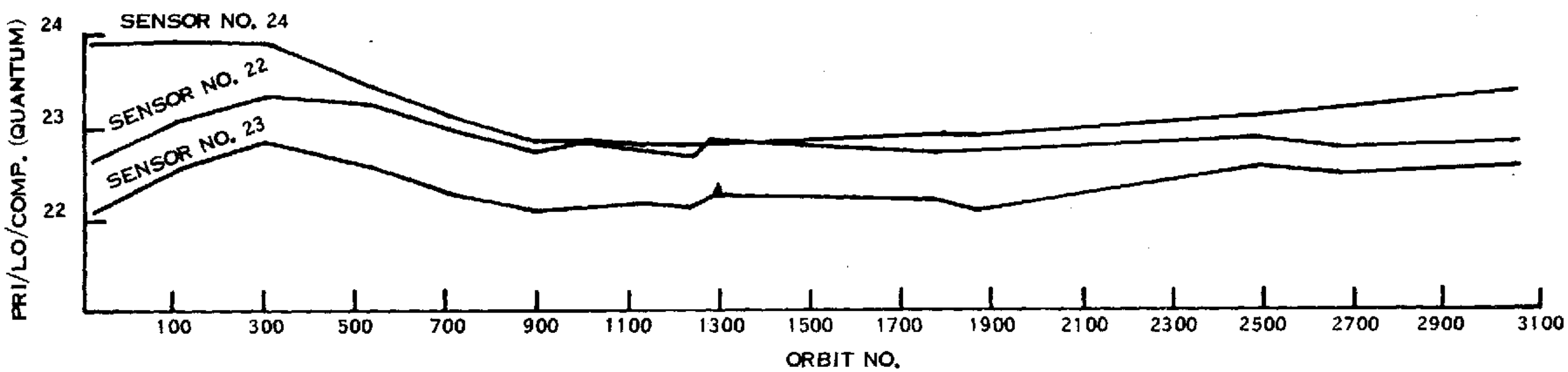

Figure 17-9. Band #4 Quantum vs. Orbit, Word #270

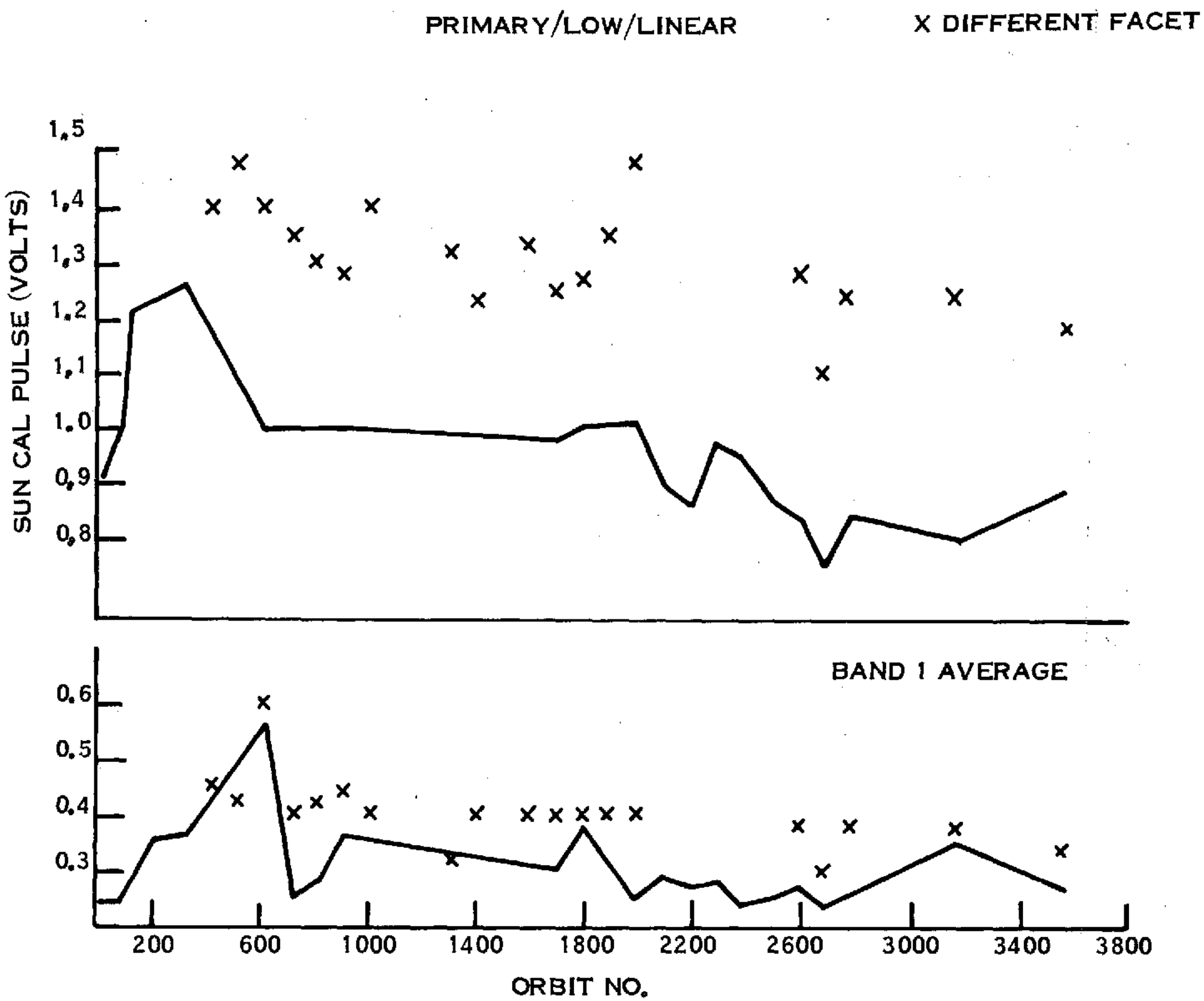

Figure 17-10. Band #2 Average

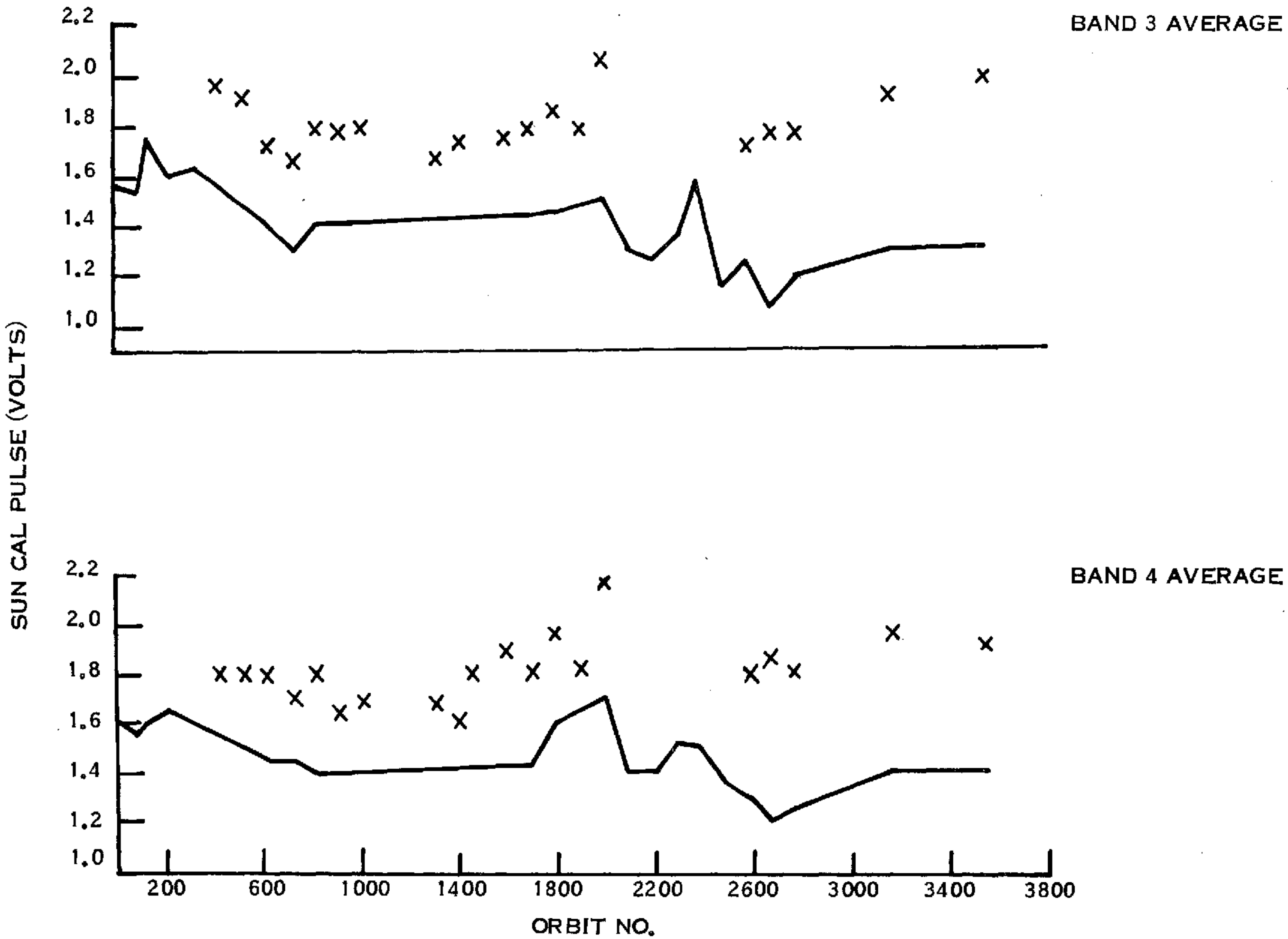

Figure 17-11. Band #3 Average

SECTION 18

DATA COLLECTION SYSTEM

SECTION 18

DATA COLLECTION SUBSYSTEM

The Data Collection Subsystem has operated satisfactorily since turn-on in Orbit 5. Between Orbits 2898 and 3102 (15 days) severe interference was experienced. The effect on receipt of valid messages was slight, but many non-messages were accepted as messages and then rejected as invalid, creating an apparent high percentage of "bad" messages. A study of the receiver AGC history shows the source of the interference originated from 33^{o}N 101^{o}W (see Appendix B).

All telemetry functions have been normal as shown in the typical values of Table 18-1.

Since turn-on in Orbit 5, this subsystem has received 243, 951 messages of which 218, 749 (89. 8%) were perfect. In periods without obvious interference, perfect messages exceed 95%. 111 ground platforms are currently active with a maximum of 103 being received during one orbit. The maximum number of messages received in one orbit was 539, received during Orbit 3764. Over 400 messages were received during 21 Orbits, and over 500 messages were received during 7 Orbits. Figure 18-1 shows the history of DCS message receipts. Notice the 18-day cycle of increase and decrease of messages.

The DCS has been on since Orbit 5 for a cumulative total of 6549 hours, 3 minutes and 25 seconds. Reception probability has remained at 99%. The system threshold continues to exceed 3400 km. No adverse effects of grazing angle or of adjacent data collection platform is discernible. The ground transmission system is also performing satisfactorily.

Prior quarterly reports have used as a system figure of merit the ratio of number of messages delivered to users divided by the number of messages received. The figures of merit in the first quarterly report was 0. 643; in the second quarterly report, the figure was 0. 656. The current figure is 0. 813. Even this figure is conservative because in the first three

months, many of the messages received were merely test messages requiring no delivery to users. As the number of messages continues to increase, the effect of those early test messages diminishes.

Appendix C contains the current DCS Platform List.

Table 18-1. DCS Telemetry Values

Number	Name	Units	T/V* 20°C Plateau	Value in Orbits			
				16	3000	3400	3810
16001	Revr 1 Sig Str	(DBM)	-119.0	-124.09	-121.07	-124.21	-124.94
16002	Revr 1 Temp	(DGC)	23.0	22.72	24.04	23.66	23.62
16003	Revr 1 Inp Volt	(VDC)	12.02	12.02	12.01	12.02	12.02

*Thermal Vacuum Test Data

Receiver 2 has not yet been used in Orbit.

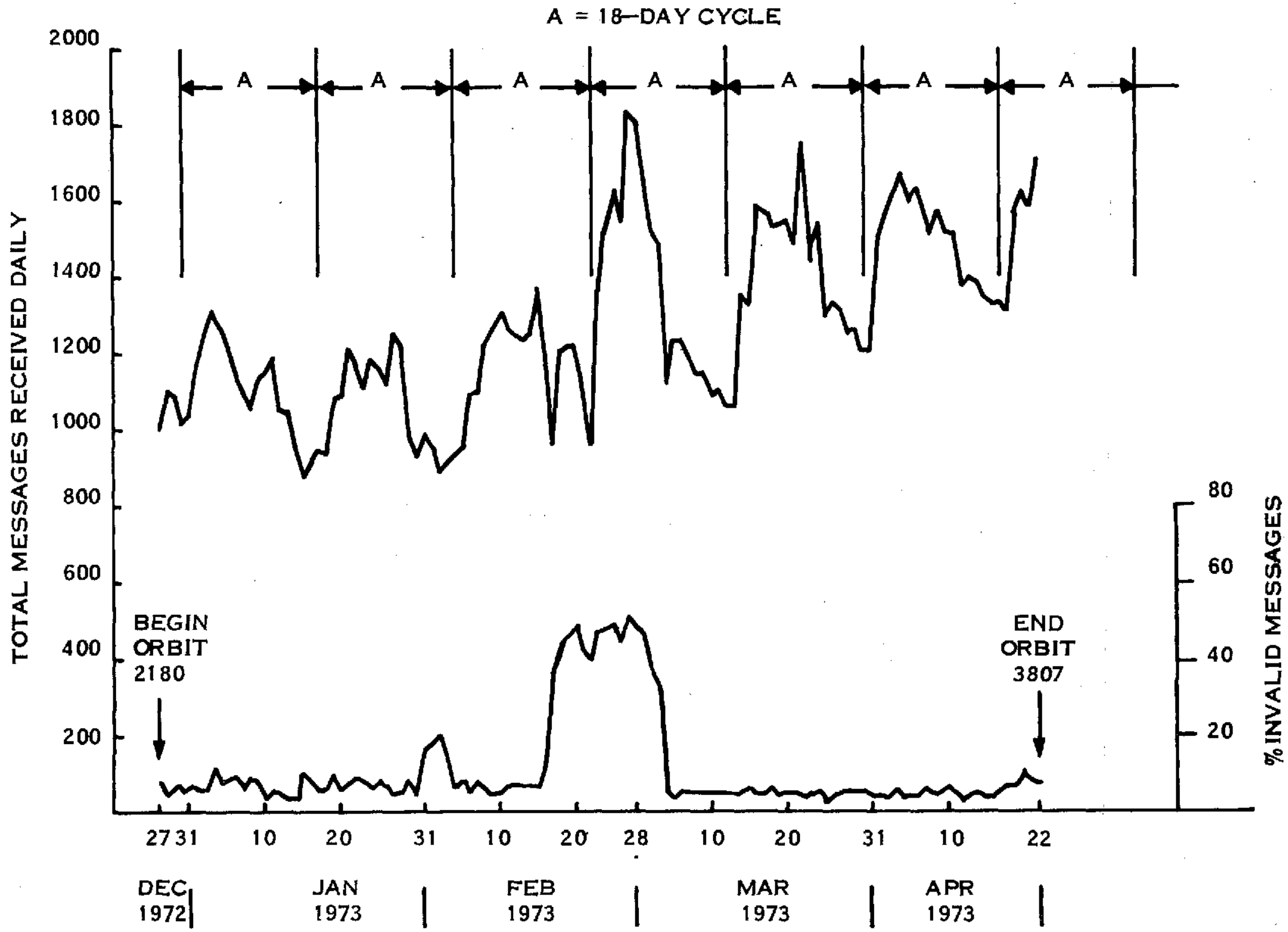

Figure 18-1. DCS Message Receipt History

APPENDIX A

ERTS-1 ISSUED DOCUMENTS

APPENDIX A

ERTS-1 ISSUED DOCUMENTS

1TH4-ERTS-78	Use of Momentary Enable Commands on ERTS-1, dated 2/6/73
1TH4-ERTS-77	Contingency Plan for ERTS-1 USB Side A to Side B Switchover, dated 2/6/73
1TH0-ERTS-81	ERTS-1 Flight Hardware Operating Time Summary, dated 3/5/73
1TH0-ERTS-86	WBVTR-1 Operating Time Summary, dated 3/8/73
1TH05-ERTS A-420	Orbital Mid Scan Code Symmetry From Orbit 2375 and Comparison to Previous Results, dated 3/13/73
1TH05-ERTS A-421	Quick Look Evaluation of Orbit 3150, Line Length, Data Quality, Band 1 Cal Wedges and Noise at Black Video Level, dated 3/13/73
1TH05-ERTS A-422	Data Thru Orbit 2389: PLL and PLC, and Sun Cal Pulse S/N; and Comparison of Mean Signal Level for Video Data and Sun Cal Orbits, dated 3/16/73.
1TH0-ERTS-84, 86	Recent DCS Interference, dated 3/13/73 and 3/23/73
1TH0-ERTS-87	USB Power Output Decline, dated 3/27/73
1TH05-ERTS A-423	Orbital Mid Scan Code Symmetry, MSS Sampled Orbits 103 to 3189, dated 4/9/73.
1TH0-ERTS-88	Quality Tests on WBVTR-1, dated 4/19/73

APPENDIX B

ERTS-1 ANOMALY LIST/REPORTS

APPENDIX B

CONTENTS

C . 2

OBSERVATORY ANOMALIES

DATE	ANOMALY	HOW OBSERVED	COMMENTS
7/24/72	SUN SENSOR TEMPERATURE HIGH	OFF–LINE	NO ACTION REQUIRED FOR ERTS 1; ERTS B REDESIGNED
7/24/72	SOLAR PADDLE TEMPERATURE EXCURSIONS GREATER THAN EXPECTED	OFF–LINE	NO ACTION REQUIRED FOR ERTS 1; MATH MODEL CORRECTED
7/25/72	USB POWER OUTPUT DECREASING	OFF–LINE	WILL SWITCH TO SIDE B WHEN NECESSARY; UNDER INVESTIGATION FOR ERTS B
8/03/72	WBVTR NO. 2 POWER CONVERTER SHORTED	REAL TIME & OFF–LINE	TURNED ALL P/L OFF DURING PASS. FORMED NASA/GE/RCA EVALUATION COMMITTEE. REDESIGNED FOR ERTS B
8/03/72	DECREASE IN SOLAR ARRAY CURRENT	OFF–LINE	EVALUATE DEGRADATION EFFECT DUE TO SOLAR FLARE ACTIVITY
8/06/72	RBV POWER TRANSIENT PSM TURN–OFF FAILURE	REAL TIME	TURNED OFF PRM. NASA/GE/RCA EVALUATION COMMITTEE FORMED – REDESIGN PSM FOR ERTS B

OBSERVATORY ANOMALIES
(CONTINUED)

DATE	ANOMALY	HOW OBSERVED	COMMENTS
8/10/72	DCS RECEPTION PROBABILITY DROPPED TO 71 %	OFF–LINE	EXTERNAL INTERFERENCE
8/10/72	MSS CAL WEDGE LEVELS DECREASING SUN CAL OUTPUTS LOW	OFF–LINE	EVALUATE DATA – CONTINUE INVESTIGATION TO IMPLE– MENT CORRECTIVE MEASURES ON ERTS B
9/03/72	INCORRECT TIME TAGS IN COMSTOR CELL 12	REAL TIME	RELOAD COMSTORS AND VERIFY
12/04/72 12/06/72	PITCH, ROLL, YAW – MOTOR DRIVE DUTY CYCLES INCREASED FOR SHORT PERIOD	OFF–LINE	EVALUATE – PREPARED CONTINGENCY PLAN. UNDER INVESTIGATION FOR ERTS B
3/29/73	WBVTR NO. 1; HIGH BER	REAL TIME	EVALUATE – FORM NASA/ GE/RCA COMMITTEE

GENERAL ELECTRIC
MISSILE AND SPACE DIVISION
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FROM	TO
J. Becek NE Subsystem Engineer	P. Jones NE Elec. System Engineer

DATE SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
5/28/70		Nimbus E	

SUBJECT

COMMAND CLOCK COMMAND EXECUTION COUNTER UPDATING

INFORMATION REQUESTED/RELEASED

Introduction

During the course of Nimbus D integration and test, a number of command executions failed to occur. Eleven of these were considered to be related to the command subsystem. In three of these instances the command execution counter did not update, so the problem was considered to be related to the transmission link. In the remainder of the command failures, the counter did update (5 times) or its status was indeterminate (3 times). The problem was not considered serious due to its infrequent occurrence and the reason for the updates without command executions was never satisfactorily established.

Conclusions and Recommendations

A number of reasons for the counter updates were postulated, but were not able to be backed up by evidence:

1) Failure for a relay to pull in
2) Harness intermittant
3) Matrix driver failure
4) Short driving pulse
5) Improperly coded command
6) Improperly decoded command
7) Erroneous counter update.

The first four reasons were not very likely due to the random nature of the failures and the ability to successfully retransmit the same command immediately after the failure. The fifth reason implies computer program error since transmission bit errors are not likely to pass the command clock's error criteria; and a program error would be expected to show up more frequently. This left the last two reasons as the most likely possibilities. An investigation by Calcomp revealed that a timing race was present between the incoming command data and the internal command clock timing which could result in the same command being executed twice with the loss of a second realtime command. This is not considered a serious problem in either the Nimbus IV command clock or in future units since all command executions are verifiable by Digital B telemetry or status changes and a missed command can easily be re-transmitted. Therefore, no design changes are recommended.

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FORM 1020B REV. (9-65)

Discussion

The command execution counter in the command clock is comprised of six flip-flops which are triggered by the trailing edge of the monostable multivibrator pulse which drives the matrix driver amplifiers. Therefore, an update of the counter indicates that a command (not necessarily the correct one) was decoded and the matrix driver amplifiers were triggered by the monostable. It does not determine whether or not a command pulse actually left the command clock.

There is a 100 kHz master clock signal in the command clock which is used for internal timing. This signal is derived from the 3.2 MHz master oscillator and is asynchronous with any incoming command data. It is used to establish a "T-counter" which consists of a series of 10-usec pulses counted from 1 to 50. When a realtime external command is received and decoded, the fiftieth (last) strobe pulse is OR'd with the T2 pulse to activate a gate (L-gate). The L-gate sets a shift control flip-flop in the comdec and matrix decoder which permits the shifting of the nine bits of command data from the comdec to a command register in the matrix decoder. The shifting takes place at a 100 kHz rate on bit times T3 through T11, when the shift control flip-flops are reset to permit no more data to shift. The L-gate also fires the monostable which turns on the MA and MB drivers selected by the data in the matrix decoder command register and creates a matrix busy term which feeds back and inhibits the L-gate and clear the comdec. The monostable pulse is nominally 40 msec wide and the drivers are gated on by the T11 term, indicating the proper data has been shifted into the command register. The trailing edge of the monostable is used to update the command execution counter.

Since the incoming data strobe and the T-counter are asynchronous, it is possible for the L-gate pulse width to vary from 0 to 10 usec. If portions of the gate derived from the 128 bps data strobe became true just as the T2 portion was preparing to go false, a very narrow pulse would result. This pulse could fire the monostable but not set the flip-flops, which require a finite time at their inputs. This would result in execution and counting of the previous command which still occupies the matrix decoder command register.

Calcomp demonstrated the above in a laboratory test using a breadboard matrix and a controlled L-gate. This test showed that pulses less than 50 nanoseconds wide would fire the monostable but not set the shift control flip-flops. The problem could be prevented by synchronizing the T2 term to the L-gate or by creating the matrix busy feedback term with the monostable firing <u>and</u> the setting of the flip-flops. Either approach would involve a design change and is not considered necessary since the problem affects only realtime commands which are monitored.

The above satisfactorily explains the problems observed during Nimbus D I&T, but leaves some questions unanswered. Since the maximum L-gate pulse width is 10 usec (governed by the T2 term) and the minimum pulse width to set the flip-flops is 0.05 usec, it appears that in a large sample, 1 out of every 200 commands should be counted but not executed. Test data showed evidence of 1 in 10,000 (estimated total). (Note: It can be assumed that the ratio was somewhat higher than this since many commands are sent to ensure a status which already exists and their non-execution would not have been observable). Also, the above timing problem could result in the first command of a transmitted sequence being missed and the last command of the preceding transmission (which is still in the command register) being executed. If the erroneously executed command was one that changes a normally automatic S/S status, an undesired response could result. This was never observed during test. It appears that there is still a missing variable which lowers the probability of this occurrence. It is believed that further investigation by Calcomp is warrented.

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K. S. Rizk	Distribution

DATE SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
March 27,1973			

SUBJECT

USB Power Output Decline

INFORMATION REQUESTED/RELEASED

Introduction

Since launch, the USB power output, as measured by telemetry, declined in power from 1.6 watts at launch to 0.35 watts in orbit 3450. No impairment to the functional operation of the USB transmitter has been observed, the expected margin being at least another 0.20 watts decline to a value of 0.15 watts. No signal-to-noise problems exist at ground stations receiving telemetry and ranging transmissions from the ERTS-borne USB. Signal-to-noise problems in DCS reception have been attributed to extraneous ground-based interference (see PIR-U-ITH6-ERTS-84 dated March 16, 1973).

Because of this trouble-free USB performance, there is a rising suspicion that the telemetry-indicated power decline in the USB may actually be only a decline in the performance of the telemetry measurements.

Objective of this Study

The objective of this study is to determine whether there has been an actual power decline in the USB, or whether the telemetry measurements were erroneous.

Summary

Ground Station AGC measurements, selected to successively reproduce the geometry and propagation characteristics of the transmission conditions, show an impressive correlation with the telemetry-indicated power decline. Despite minor incongruities in the data, the trend is clear and unmistakable leaving no reasonable doubt that the telemetry data is authentic.

Discussion

At launch, the power output of the USB-A transmitter was reported by telemetry to be 1.6 watts. As shown in Figure 1, the power output declined with time, generally dropping abruptly in periodic steps of 0.1 to 0.2 watts.

B. Phucas
L. Seaman U2101
H. Boys U2101
T. Winchester
R. Pahmeier M-2626
S. Sander (2) M-2626
L. Smith Code 430
E. Painter Code 430
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J. Effner
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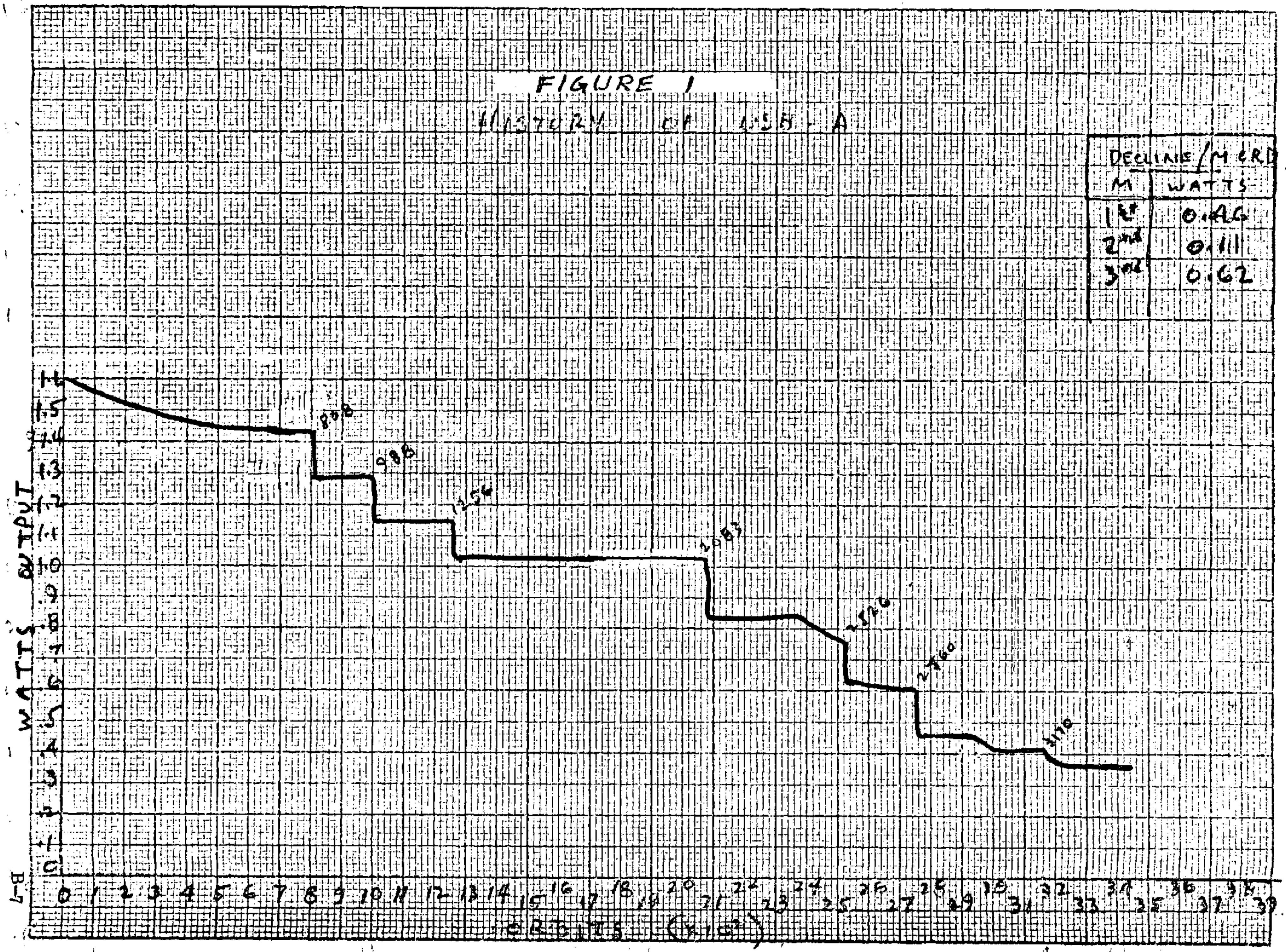


FIGURE 1
HISTORY OF 458-A
DECLINE
M
WATTS
1st
0.46
2nd
0.11
3rd
0.62
808
988
1256
2083
2526
2760
3170
WATTS OUTPUT
ORBITS (x10²)

The signal level at the ground stations, as measured by the voltage on the automatic gain control (AGC) circuit generally followed the pattern of telemetry-indicated USB power decline as was reported in the last two quarterly ERTS-1 Flight Evaluation Reports dated November 1972 and March 1973. However, correlation of the AGC readings with USB power output is complicated by considerations of azimuth, elevation and range conditions during transmissions, spacecraft attitude and antenna patterns, by ground station equipment (e.g. an 85-foot diameter antenna versus a 30-foot diameter antenna), and by equipment condition and calibration accuracy. Regular field reporting of AGC levels characteristically show standard deviation of two or more decibels. The downward trend, however, was sufficiently apparent to permit the conclusion in the quarterly reports that the USB power was actually declining as indicated by telemetry. In order to ascertain whether this conclusion was justified or not, a technique is needed to eliminate the effects of geometry, spacecraft antenna pattern and ground station variations.

The telemetry point at the USB diplexer is sensitive to the voltage standing wave ratio (VSWR) and to the length of the line between the diplexer and the antenna. Because there is no isolation in this circuit, the telemetry voltage is also potentially exposed to power flowing into (e.g. from the 20 watt WPA-1 radiations) as well as to the power flowing out from the USB. Furthermore, the transmitter unit now operating in the ERTS spacecraft (EAB-FT-2) is not the one tested and calibrated in thermo-vacuum (EAB-FT-1). Before launch, EAB-FT-2 had been in operation for only 177 hours, while EAB-FT-1 had been operated for 1855 hours previously. The calibration curve in current use was derived from the EAB-FT-1 unit. A signal generator was fed to the diplexer yielding VSWR of about 1.3 not really representative of flight conditions which characteristically yield ratios of 1.4 to 1.5. Furthermore, due to the low power output of the signal generator, it was only possible to derive values for the calibration curve at about 0.4 watts. Later, a calibration test was made with the unit installed in the ERTS spacecraft but with no means for varying the power output. Thus, it was only possible to derive values for the calibration curve at around 1.1 watts, the normal power output for the EAB-FT-1 unit. With these two regions on the curve established, the remainder of the curve was derived analytically. EAB-FT-2 which was installed in the ERTS one month before launch had a power output of about 1.6 watts. The inadequacy of the calibration curve became apparent after launch when the telemetry indicated values above 2 and 3 watts--an impossible condition, thereby flagging calibration inaccuracy in that region of the curve, at least. The calibration curve was then revised analytically.

Figure 2 shows the old and the new calibration curves. In the region above 1.2 watts, it is seen that the disparity between the old and new curves is huge (above 0.3 watts) and increases rapidly with increasing power. But in the region below this value, where it has been operating since orbit 988 (see Figure 1), the difference is a maximum of 0.12 watts. The calibration curve itself cannot therefore be considered a contributing factor to the apparent USB power decline.

The orbital parameters of ERTS-1 are maintained such that every 252nd orbit repeats the ground trace. Thus, the conditions of azimuth, elevation, slant range and spacecraft antenna pattern will be repeated every 252 orbits. Orbits

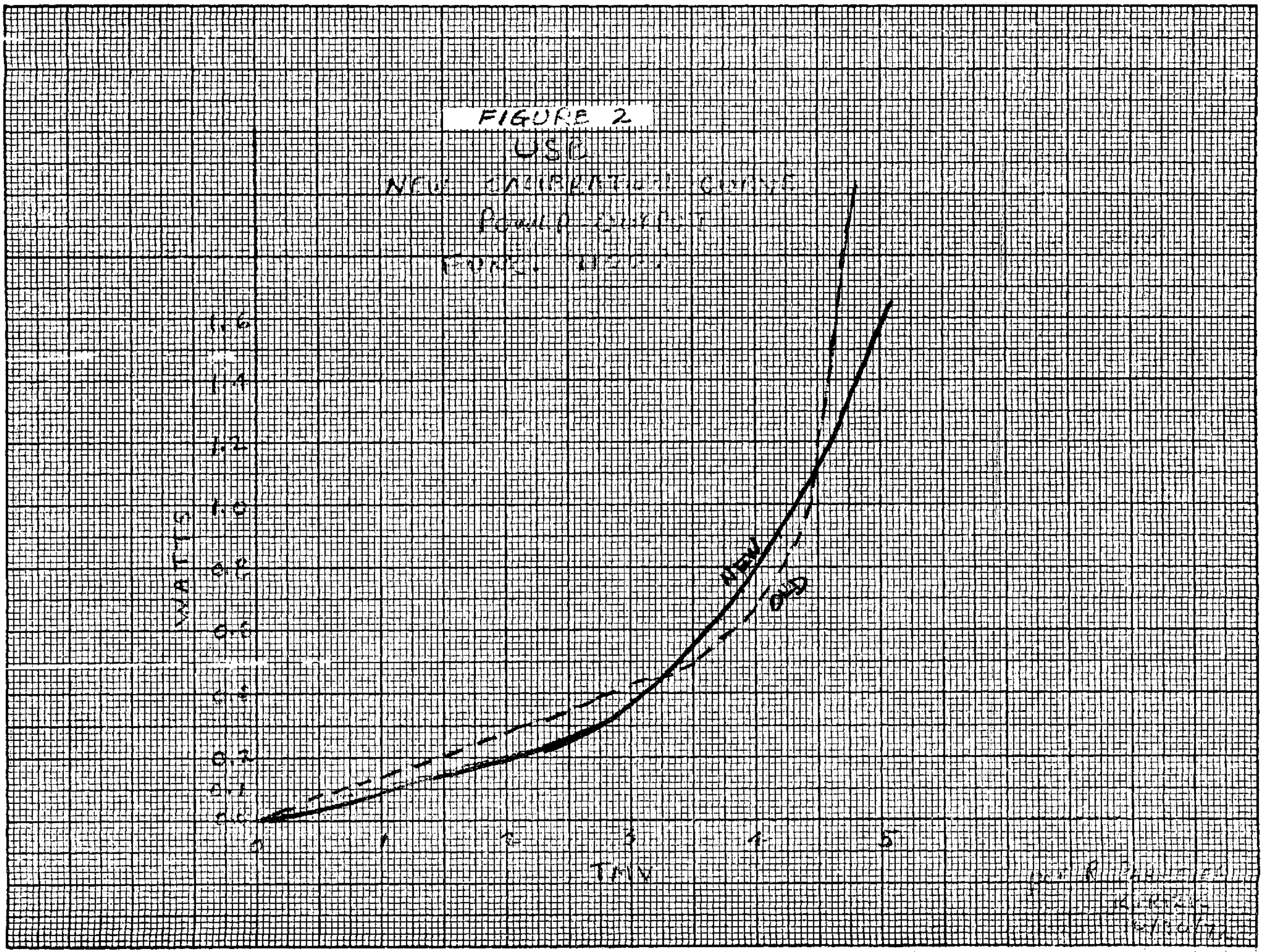


FIGURE 2

0 through 115 are classed as cycle 0, and thenceforth, every 251 orbits constitute a cycle; i.e. cycle 0, 1, 2.... The AGC values measured at the ground stations are for points of maximum AGC value, normally at the point of closest approach unless affected by the s/c antenna pattern. Therefore, if AGC readings from one cycle are compared with readings from its corresponding orbits in succeeding cycles, for each ground station, it will be possible to obtain nearly identical conditions of azimuth, elevation angle, slant range and spacecraft antenna pattern. Then AGC readings will be responsive only to USB radiated power, providing the ground equipment is maintained and calibrated satisfactorily.

In Table 1 for Goldstone operations, two orbit families are selected: one for orbit 41 plus each 251st succeeding orbits, and the other for orbit 42 plus each 251st succeeding orbit. For these orbits, the maximum AGC readings at Goldstone for USB transmissions (Link 4) are listed. Also given are the slant ranges, azimuths and elevation angles measured at Goldstone.

In Figure 3, the data from Table 1 is plotted and a smooth curve drawn for each orbit family. For the same orbits in each cycle, the USB power output history is also plotted in relative db values, from the curve in Figure 1.

The trend and general shape of the AGC curves are similar to the trend and shape of the USB power output curve derived from telemetry. The initial decline, the flattening in the center and the later decline is similar in the three curves. The total drop in indicated power is also similar, but not identical. The decline as indicated by AGC readings are 4db and 4.4 db for the ranges of 1045 Km and 2140 Km. respectively; as compared with the 6db power decline shown by telemetry. It has not yet been determined whether this difference is due to variations in spacecraft attitude or ground station performance, but in any case, it does not affect the impressive correlation of the telemetry curve with the AGC curves.

Figure 4 shows the USB antenna pattern, with the points of maximum AGC shown by large dots, and the approach path shown by a line. The points of maximum AGC readings are on contour levels separated by 4 db. The transmission distances are in ratio of 2/1, adding another 6 db. Thus, a total of 10 db is expected between the two curves of Figure 3, which is in close conformity to the actual difference in Figure 3, showing internal consistancy in the data.

To determine whether the orbits selected in Table 1 are typical of all the orbits, the db spread of the orbits of Table 1 are compared with the published AGC reports in the last two quarterly reports. In Figure 5, these data are plotted. It is clear from this Figure that the data from Table I is consistant with the data from the two quarterly reports.

Similar investigations were made of the AGC levels received at Greenbelt and Alaska for similar families of orbits. In Figures 6 and 7 these data are plotted. Though differing somewhat in shape and magnitude of decline, the downward trend is confirmed unmistakably in all the data. The magnitude of decline for Greenbelt was 8.2, 7.6, and 6.2 db for slant ranges of 915, 1060 and 1960 kilometers respectively. For Alaska, the magnitude of decline was 10, 9 and 9.2 db. for slant ranges of 980, 1600 and 2050 kilometers respectively. The Greenbelt data resulted in a smooth curve with standard deviations about 1.7 db. The Alaska data resulted in an exaggerated shape of the tele-

TABLE 1

GOLDSTONE AGC READINGS ON
LINK 4 WITH 30-FOOT ANTENNA

CYCLE	ORBIT	AGC DBM	ORBIT	AGC DBM
0	41		42	-86
1	292	-100	293	-89
2	543	- 98	544	-90
3	794	- 97	795	-88
4	1045	- 98	1046	-90
5	1296	- 99	1297	-92
6	1547	- 99	1548	-90
7	1798	-100	1799	-90
8	2049	-100	2050	-90
9	2300	-102	2301	-93
10	2551		2552	
11	2802	-100	2803	-90
12	3053	-102	3054	-92
slant range	2140 Km		1045 Km	
el ang.	17°		59°	
azimuth	97°		282°	

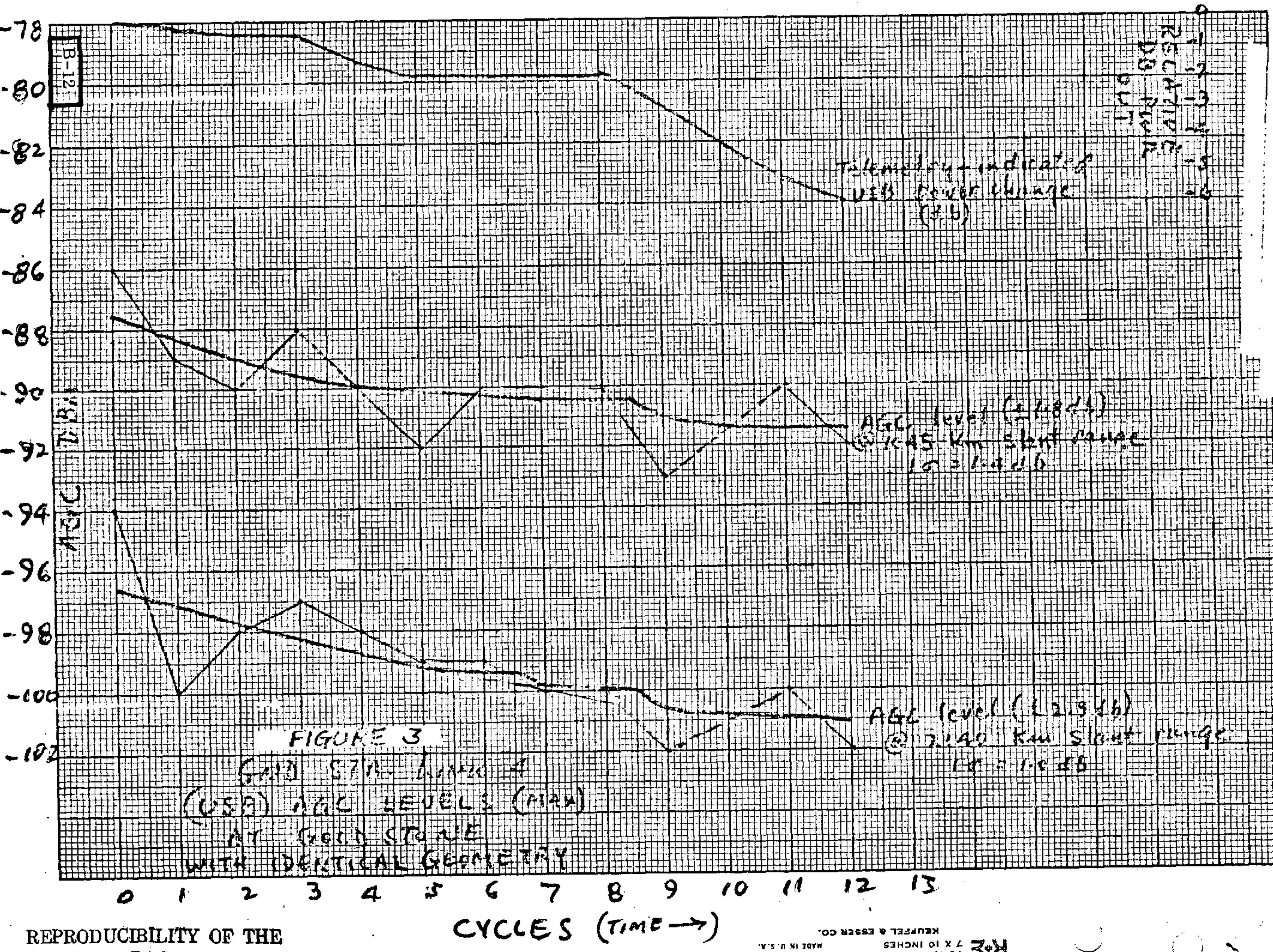
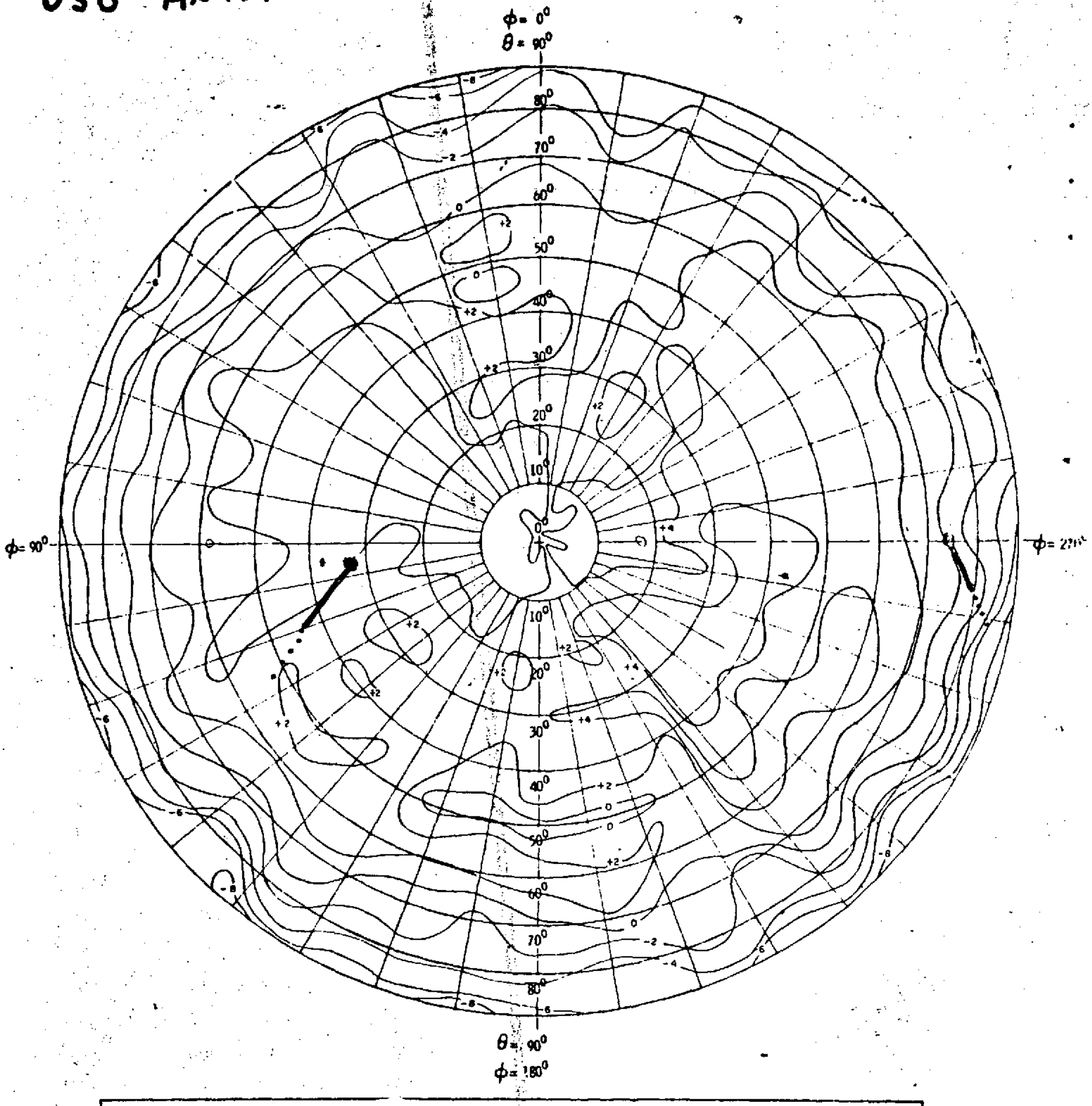


FIGURE 3
(USB) AGC LEVELS (MAX)
AT GOLD STONE
WITH IDENTICAL GEOMETRY

FIGURE 4
USB ANTENNA PATTERN



POWER CONTOUR GRAPH			
PROGRAM	ERTS-A	POLARIZATION	RC
ANTENNA	USB	GAIN REFERENCE	ISOTROPIC
FREQUENCY	2287.5 MHz	ENGINEER	C. POST
MODEL SCALE	FULL		M DREXLER
REMARKS			
HEMISPHERE TOWARD EARTH			

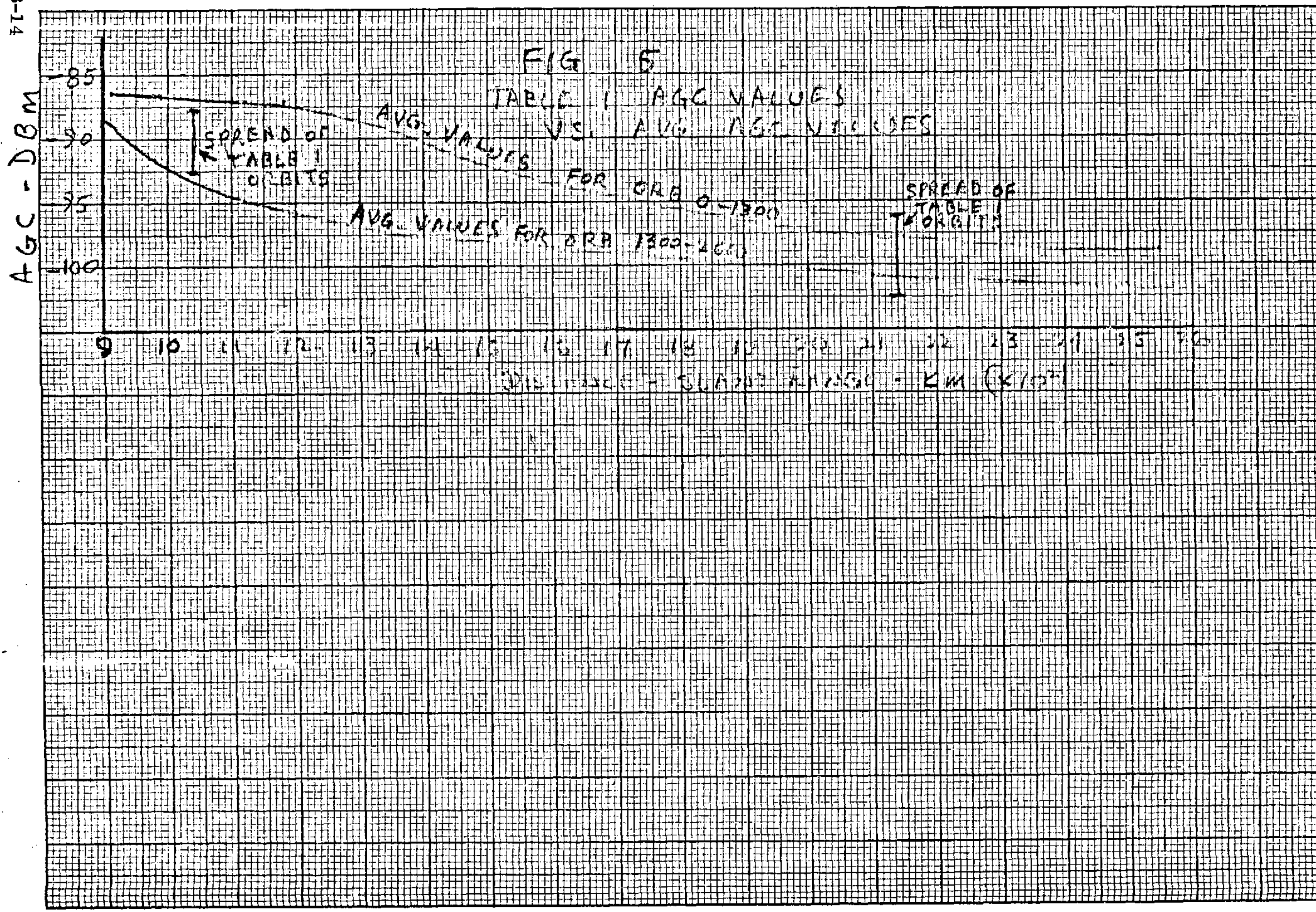


FIG 6
TABLE 1 AGC VALUES
VS. AVG AGC VALUES
AGC - DBM
-85
-90
-95
-100
SPREAD OF TABLE 1 ORBITS
AVG VALUES FOR ORB 0-1300
AVG VALUES FOR ORB 1300-
SPREAD OF TABLE 1 ORBITS
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
KM

metry-indicated power output values with somewhat higher standard deviations. Alaska uses an 85-foot antenna and Goldstone uses a 35-foot antenna, accounting for most of the difference in power levels between Figure 6 and Figure 7.

As in the case of the Goldstone data, the data for Greenbelt and Alaska were tested for internal consistancy and conformance with data from the prior published quarterly reports, with similar favorable results. The 6.6 db difference at Greenbelt between the AGC readings at 915 kilometers and at 1960 kilometers show consistancy in the data. The 7.5 db difference at Alaska also is consistant, when coupled with the spacecraft pattern antenna effects. For both stations, comparison of the data from these selected families of orbits with data from all orbits (see 2 Quarterly Reports), the results are favorable-similar to that shown in Figure 5 for Goldstone.

As a final comparative test, to determine whether ground station results might change with time as personnel, equipment, adjustments and procedures changed, it was felt useful to examine the AGC level measurements of another spacecraft transmitter. Figure 8 shows the ground station measurement of Wide Band Power Amplifier -2 during the same time period. The small decibel difference at different slant ranges is due to an antenna pattern designed to yield an equal field at all distances in its horizon. It is seen that the measured AGC shows no decline with time at both ranges. It is, therefore, not reasonable to attribute the USB decline in AGC levels to a change in standards at the ground stations.

Conclusions

The power output of the USB has declined with time in general conformity with the telemetry values.

FIGURE 6

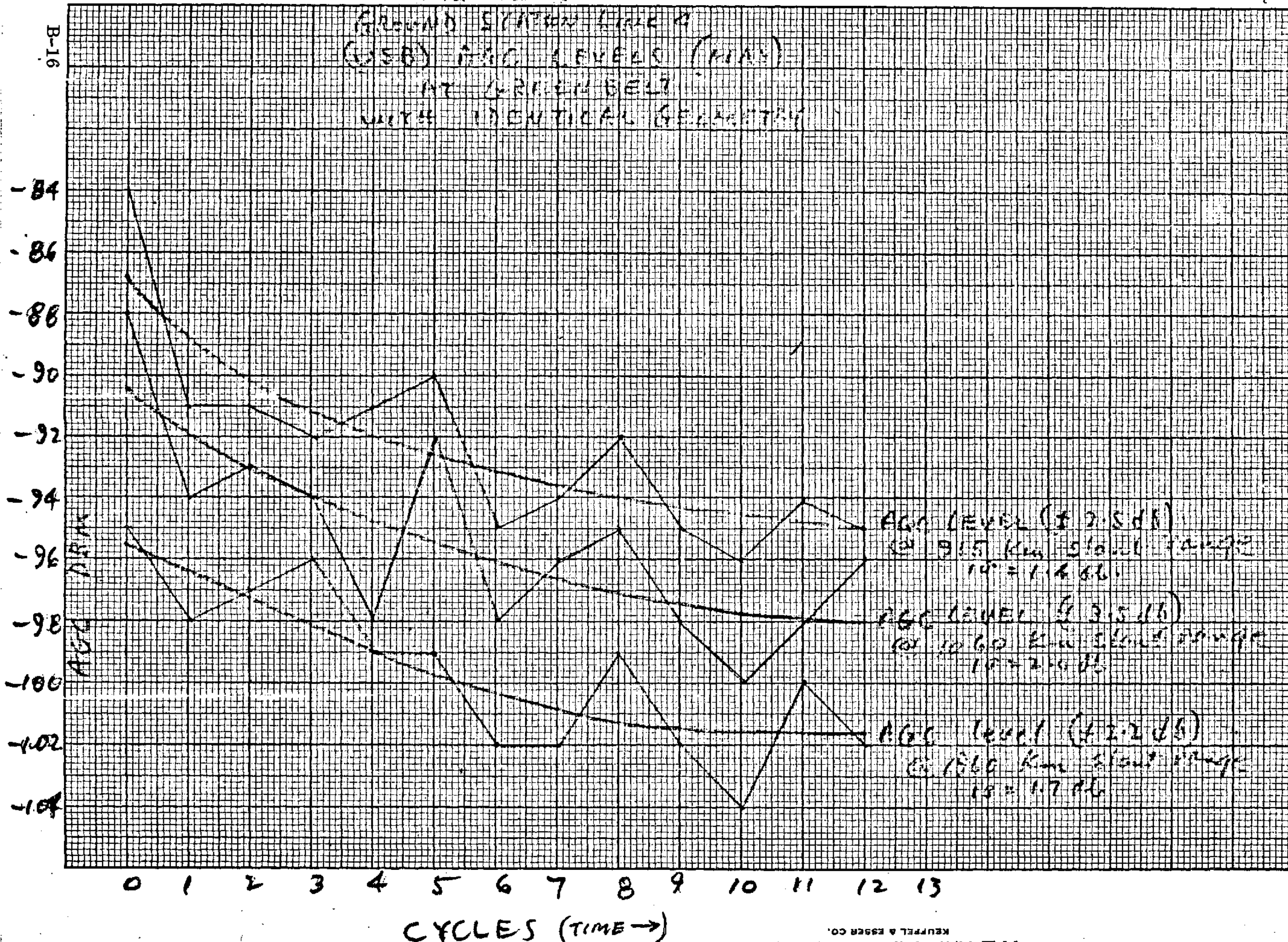
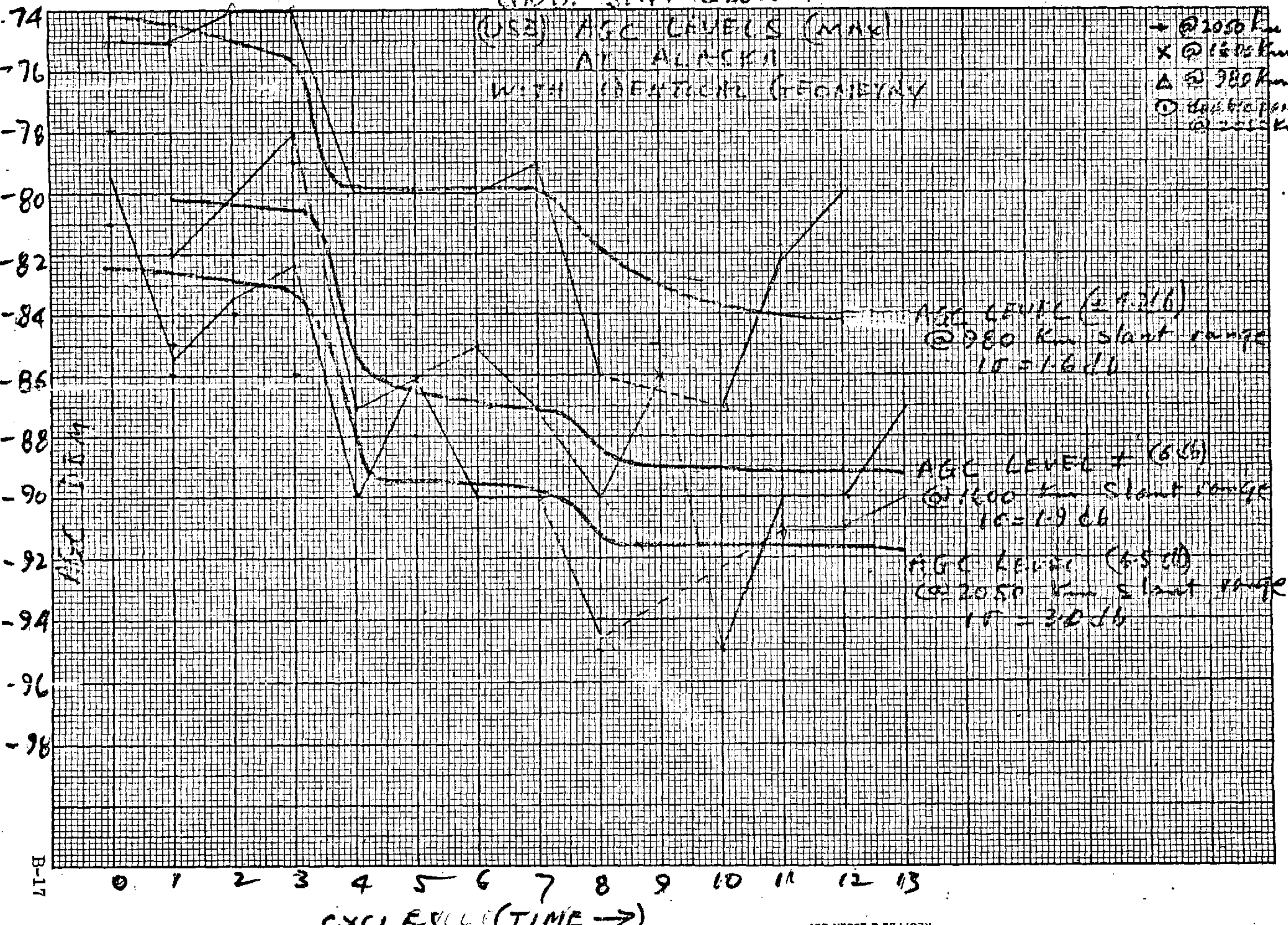

AT GREENBELT
WITH IDENTICAL GEOMETRY
-84
-86
-88
-90
-92
-94
-96
-98
-100
-102
-104
AGC DBM
AGC LEVEL (± 2.5 dB)
1σ = 1.4 dB
AGC LEVEL (± 3.5 dB)
AGC level (± 2.2 dB)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
CYCLES (TIME →)

FIGURE 7
GND. STA. LINK 4



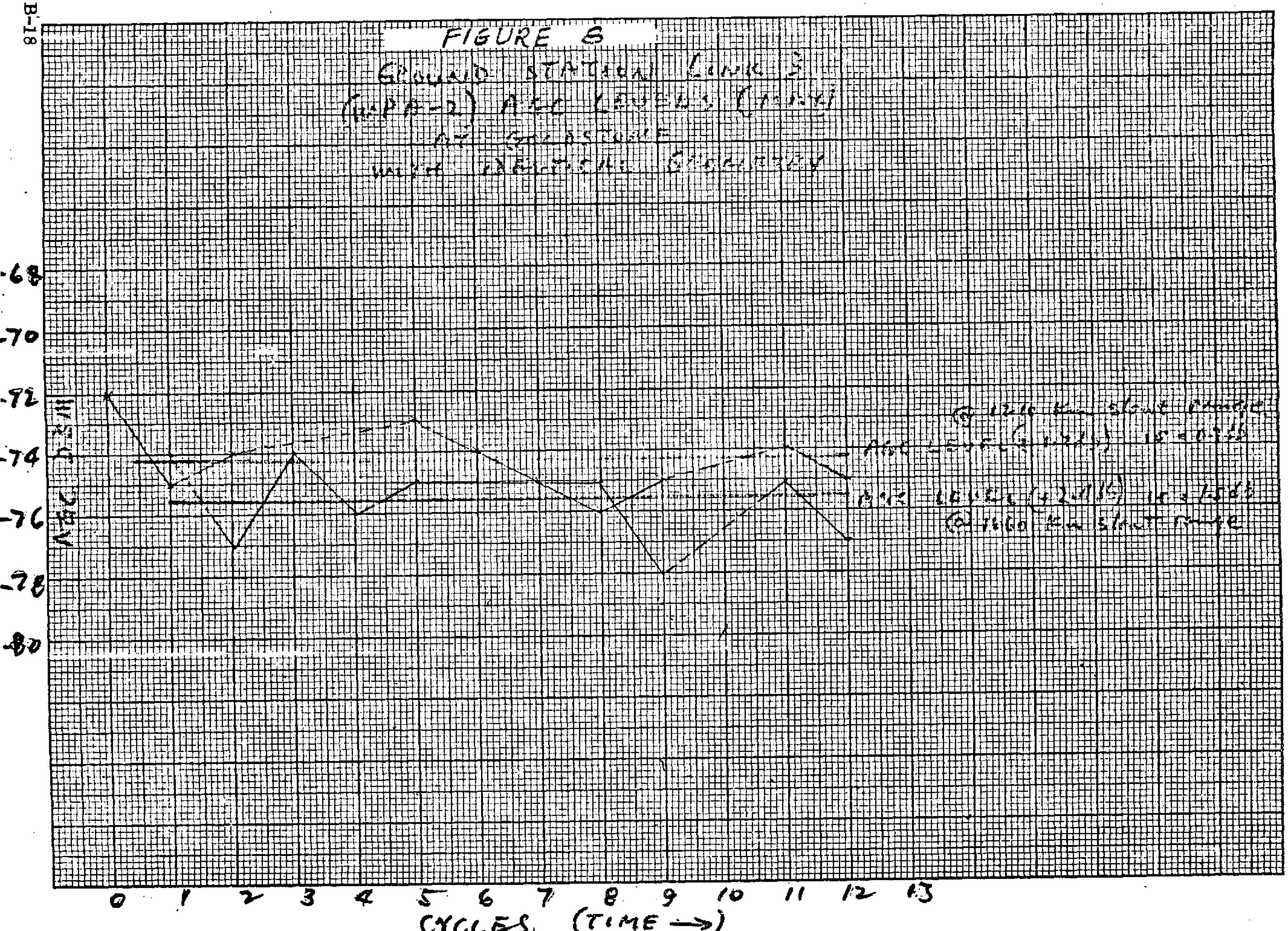


FIGURE 8
-68
-70
-72
-74
-76
-78
-80
0 1 2 3 4 5 6 7 8 9 10 11 12 13
CYCLES (TIME →)

GENERAL ELECTRIC

5030 HERZEL PLACE

BELTSVILLE, MD. 20705

SPACE SYSTEMS

COPIES:

March 30, 1973

SUBJECT

WBVTR-1 ABNORMALITY

TO: R. Crouse/ T. W. Winchester

FROM: K. S. Rizk

On 29 March 1973 during MSS playback in orbit 3463, the MFSE counts all exceeded 400.

Further investigation showed that all playbacks after orbit 3462 show high MFSE counts.

The Headwheel Motor Current for the WBVTR-1 rose after orbit 3462 as shown below.

MODE	ORBIT 3425	ORBIT 3464
Playback	0.68 ± 0.03 amp	0.95 ± 0.05 amp
Record	0.70 ± 0.03 amp	0.80 ± 0.05 amp

Headwheel current increased slightly in orbit 3465, then receded to its near-normal level by orbit 3467, but the MFSE count remained high. The capstan motor current varied only slightly.

An examination of the WBVTR operation during a record session, and the subsequent playback in three different orbits, is shown below (March 28-29, 1973):

W I D E B A N D R E C O R D					W I D E B A N D P L A Y B A C K		
	GMT		SEG FOOTAGE				
Orbit No.	Start	Stop	Start	Stop	Orbit No.	Sta.	MFSE Counts
3455	12:14:54	12:21:53	742	882	3463	N	422, 1150, 1247, 1879, 501, 542, 1890, 465
			882	959	3462	A	4, 5, 11, 43, 23
			959	1167	3461	A	15, 2, 11, 13, 3, 6

This shows that the abnormality did not occur until orbit 3463.

DIAL COMM 8*271-1150

GENERAL ELECTRIC

All playbacks after orbit 3462 have had high MFSE counts as shown below.

ORBIT	STA	GND STA AGC dbm	MFSE COUNTS
3462	N	-77	422, 1150, 1247, 1879, 501, 542, 1890, 465
3464	A	-65	485, 471, 445, 706, 820, 603
	N	- 8	37, 142, 53, 218, 142, 493
3465	G	-77	412, 3070, 13274, 9565, 10975, 6035, 5127, 6270, 6605, 7100
	A	-65	9000, 9000
3466	A	-64	55, 294, 1185
3467	A	-65	987, 471, 37, 175, 360, 7692

Subsequently, during Real-time pass 3470 at ENT the MFSE count read from 0 to 6, normal for ENT which has a long land line between the receiving site and OCC.

It is, therefore, concluded that about the time of orbit 3463 (just after midnight GMT on March 29, 1973) an abnormality occurred to WBVTR-1 affecting its playback performance severely.

Attached is a summary of WBVTR-1 operations.

K. S. Rizk

K. S. Rizk
Off Line Evaluation

/gew

W B V T R - 1

T H R U   O R B I T   3 4 6 2

Flight On-Time	544:08:55
Video Head Contact Time	
In Flight	426:53:21
Pre Flight	126
Total	552:53:21
In - Out Cycles of Video Head Contact	3986
% Record Mode	36
% Playback Mode	43
% Rewind Mode	20
% Standby Mode	1

KSR
3/29/73
KSR

RCA

April 19, 1973

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Attention: Mr. J. M. Hayes
Code 734

Dear Jack,

Attached is the Preliminary Report (RCA Doc. No. 317) for the ERTS 1 WBVTR 1 Anomaly requested by Gil Branchflower at our meeting here at RCA on Friday, April 13th. A Final Report will be prepared when all tests and data reviews pertaining to the Prototype anomaly have been completed.

Yours truly,

John B. Long
Aerospace Programs
Recording Systems

JBL:bj

attachment

Analysis of WBVTR #1 Anomaly

(Preliminary Report)

On March 29, RCA received a report that WBVTR #1 (RCA Prototype) recorder gave anomalous performance during the playback of data obtained during orbit 3463 and subsequent operations. Specifically, it was stated that the picture content was noisy, that the headwheel current was high and that the capstan current may also be above normal. Personnel from RCA visited GSFC on the same day and the next to observe the data firsthand. Recorder malfunction was easily verified, expecially noting the time interval between noise bursts. This was determined to to be 3.2 ms, corresponding to the time required for one revolution of the headwheel motor. As a result of this determination, a more thorough search for the cause of recorder malfunction was initiated. An initial assessment of the recorder problem was attributed to a broken flexure and/or debris on the headwheel. Subsequent data analysis has yielded the following information:

1.0 Computer Print Out of 1 MSS Frame

A computer print out of a single MSS frame was generated by NASA to yield a more accurate appraisal of the noise distribution. To accomplish this task all video signal levels (within one spectral band) on the white side of a particular gray level were set below a threshold. All other gray levels were printed out in an analog signal level. The analysis of this data show the following:

1.1 The distribution of errors on the gray scale showed a predominance in the range of 14 to 17 levels away from black, indicating that the errors out of the recorder were primarily of the logic "1" type. This in turn could be interpreted as a period of reduced FM carrier level signal in the recorder, possibly caused by tape dropouts. See Figure 1.

1.2 The distribution of errors in the time domain showed that the typical duration of an error burst was around 150 us. It also showed that the errors would start out at a low rate, then build up to a high rate and then drop to a lower rate. This would tend to indicate that the errors were not occurring at the beginning or the end of each head scan, i.e. not near the video head switching interval. See Figure 2.

1.3 The time intervals between centers of the noise bursts were measured but showed no discernible timing pattern. See Figure 3.

1.4 The duration of the burst errors were measured and were found to contain some periodicity; these were approximated to be 7, 33, and 50 Hz. The first frequency corresponds to the hunting frequency of the headwheel motor. The other frequencies could not be readily identified with any known mechanical resonances of the headwheel motor or transport unit; these feqquencies possibly are best frequencies between the actual mechanical phenomena and the sampling rates.

2.0 Analysis of 70mm Film

A 70mm film of orbit 3464 was furnished to RCA covering several spectral bands. This film was analyzed in an effort to obtain a more accurate distribution of the noise signature. A review of the data thus obtained shows the following:

2.1 Interruption of the entire MSS playback processing occurred occasionally after a sequence of very high errors generated by one head of the recorder. At other times, the picture generating process was interrupted for no discernible reason.

2.2 The noise distribution for extended periods of time remained with one particular head, occasionally varying from a duration of a few hundred microseconds to a full head scan (800 µs).

2.3 Noise bursts that nearly cover the duration of one head scan frequently show reduction of errors in the middle of the head scan. See Figure 4.

2.4 Occasional noise bursts extending over more than one head scan were noted, including an occasion where the noise pattern clearly shifted from one head to a subsequent head within an interval of 2 seconds. See Figure 5.

2.5 The noise distribution in one spectral band does not always correspond to that of another spectral band. This is primarily noted when continuous tracks of errors are generated.

3.0 Analysis of TR70 Tape

NASA has furnished RCA a dub of a magnetic tape of orbit 3464. This tape was analyzed by synchronizing the timing base of an oscilloscope to the once-around rate of the TR70 headwheel panel. This would yield a close simulation of synchronizing the oscilloscope to the headwheel panel of the spaceborne recorder. The following data was obtained:

3.1 For any one recorder or playback period, the noise in the MSS signal remained primarily with one head.

3.2 When the noise duration extended over one complete head scan, the errors seem to be concentrated at the beginning and at the end of the head scan while showing reduced error rates at the center. See Figure 6. There were occasions when the noise would shift from one head to the next.

3.3 A few instances were noted where all four heads would have equally timed noise bursts throughout all four head scans. See Figure 7. This is a typical noise pattern corresponding to a longitudinal tape imperfection.

4.0 Headwheel Current Analysis

Using the telemetry strip chart readings, the variations in headwheel current were analyzed. The following data has been extracted.

4.1 During the peak of the anomaly, the headwheel current was found to rise in a reasonably smooth slope from a previous level of approximately 700 ma to a level in excess of 1 ampere. The current then reduced to the level of approximately 600 ma and has remained there.

4.2 A review of the early headwheel motor current history has shown that between orbits 3205 and 3206 the headwheel motor current had jumped from about 620 ma to 800 ma and subsequently settled at around 700 ma. Poor MSS signal performance was also reported at this time. However, data for a more detailed analysis of this malfunction has not yet been made available.

4.3 Prior to this anomaly, the headwheel motor current level had been approximately 560 ma and has jumped to 620 ma some time after orbit 2400. Again no specific data is available to further characterize this change.

5.0 Minor Frame Sync Error Analysis

Throughout the anomalous period, the variations in minor frame sync errors have been analyzed in an effort to discern any characteristic patterns or correlations. In general, it can be stated that the abnormal minor frame sync errors have been quite variable as they most likely are a function of the record and playback process.

5.1 Good correlation has been obtained between minor frame sync errors and playback voltage. In particular, whenever the playback voltage would fall to abnormally low levels the minor frame sync errors were high.

5.2 Some correlation has been found between minor frame sync errors and the change in headwheel motor current between recording and playback of the same data; however, exceptions to these observations were also noted.

5.3 Correlation between minor frame sync error and headwheel motor current during playback has also been noted. Again numerous exceptions can be identified.

5.4 No correlation has been found between minor frame sync errors and the number of record/playback passes that a particular segment of tape has experienced.

6.0 Capstan Current Analysis

An attempt has been made to note any abnormal deviations in the capstan current. No deviations beyond those normally encountered have been found during or after the peak of recorder malfunction.

7.0 Electronic System Analysis

A review was made of electronic components that could account for the recorder anomaly. It is obvious that recorder performance is completely normal except for periods when the headwheel panel shoe is closed. This would require that the recorder performance anomaly be related to the circuit that powers the hold coil of the shoe mechanism. No single point electronic failures and no reasonable multipoint electronic failures can be postulated that could link the above electronic circuit with the other observed anomalies, i.e., increased headwheel current, decreased playback voltage, and MSS error rates extending for only a portion of the head scan.

8.0 General

After the review of the data outlined above, it became highly desirable to place the recorder back on a limited operating cycle. It was determined that the worst possible failure modes related to the observed anomalies could not seriously impair the other functions of the spacecraft, therefore, short record/playback runs were made from the beginning-of-tape. The results of these runs have shown conclusively that the minor frame sync error rate was highly repetitive as a function of tape position. This leads to the conclusion that during the height of the anomalous recorder performance, the tape surface was damaged.

At this point, it became a reasonable assumption that the primary cause of the anomalous behavior of the recorder was due to debris being picked up by rim of the headwheel, the debris occasionally spilling over on to the heads and thus reducing the playback voltage. It was also decided to proceed with a tape lapping operation which would be expected to give the recorder some additional reliability margin over that achieved by the natural recovery of the recorder. A summary letter (Appendix A) was written at this time. Since the lapping operation, the recorder has again been operated in the limited mode at the beginning-of-tape. There has been no significant change in the performance of the recorder although a slight decrease in headwheel motor current may be discerned. This minimal change in performance had been predicted, further verifying that the tentative analysis was correct.

F. L. Putzrath

GENERAL ELECTRIC
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*USE "C" FOR CLASSIFIED AND "U" FOR UNCLASSIFIED

FROM	TO
K. S. Rizk	

DATE SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
4/19/73			

SUBJECT

QUALITY TESTS ON WBVTR-1

INFORMATION REQUESTED/RELEASED

Introduction

In orbit 3463, after midnight GMT on March 29, 1973, during playback of WBVTR-1, very high minor frame sync error (MFSE) counts were observed. The recorder was not used in its normal mode after orbit 3469. A study was begun to determine the nature of the abnormality and to plan a future course of operation for the recorder.

For a detailed discussion of the abnormality, see March 30 memo on this subject. Activities during orbits 3454 to 3467 were discussed.

Since that time, a detailed study of all the data is being made at RCA to determine the cause of the anomaly, the history, and the options available for resumption of operations with the recorder. To supply continuing information for this study, selected recordings and playbacks are being made and the resulting MFSE counts are correlated with tape footage, headwheel current, playback voltage and telemetry information.

Discussion

Beginning on April 11, 1973, a daily record and playback operation was performed. Generally, about seven scenes were taken in western Africa, and played back at Greenbelt two orbits later to observe the MFSE count. Only the video tape section between 12 and 215 feet (approximately) was used, so as not to risk damaging the remainder of the tape which is potentially usable to 1853 feet. These operations were performed during the orbits shown in Table 1.

It is seen from Table 1 that a LAP operation of the WBVTR was performed on Orbit 3728. In this operation, the tape footage was advanced beyond the End-of-Tape stop (1853.5 feet) to an abrasive section 15 feet beyond. The tape was advanced 12 feet into the LAP section, providing over 3600 passages of each head across the abrasive material on the tape.

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	3 MOS.	6 MOS.
	6 MOS.	12 MOS.
	MOS.	MOS.
		DO NOT DESTROY

FORM 1020B REV. (9-70)

The MFSE counts for the last six playbacks in Table 1 are plotted in Figure 1. The plotted points in Figure 1 give a MFSE count accumulated over the prior 10 seconds, equivalent to 10 feet of the tape. Hence, the count cannot be used to identify a footage line of the tape, but can only localize it to the prior 10 feet, with no information on the count distribution thru those 10 feet.

Above the MFSE plot are plots of headwheel motor input current, and of playback voltage. There is a clear trend to higher headwheel motor current with higher MFSE counts. The absolute value of the current (between 0.5 and 0.6 amperes) however is far below the value during the anomaly when it rose to saturation at 1 ampere. The value now is about what it has averaged since launch except for a rise in the orbits 3205-3300 and the period of the abnormality. (See Figure 2.)

The Playback voltage shows a trend to drop with rise in MFSE counts but the correlation is not yet clear.

Conclusions

1. Lapping may have slightly reduced the MFSE count, but did not significantl affect the area of usability of the tape.

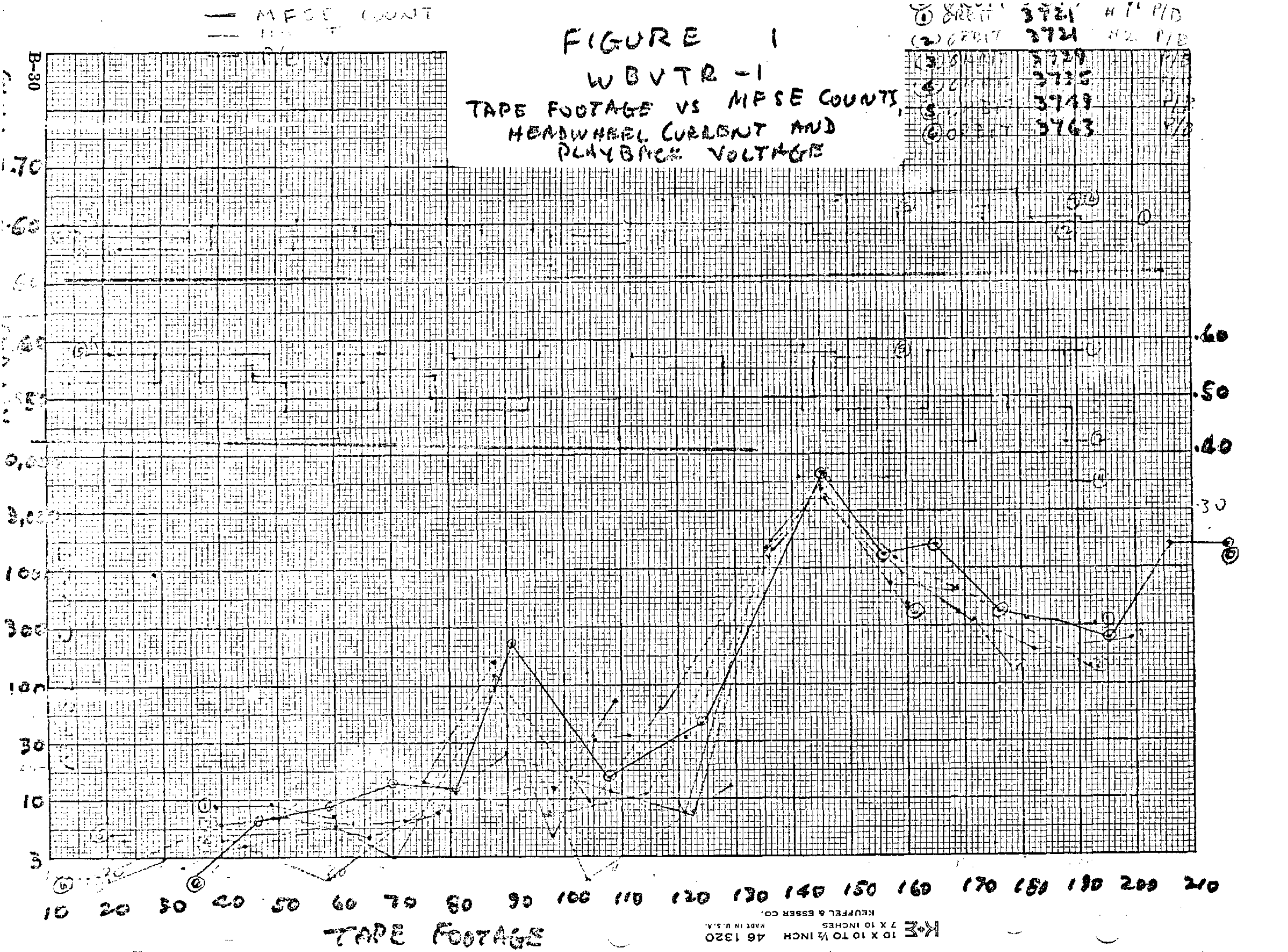
2. A section of the tape between 80 and 90 feet consistantly produces MFSE counts above 100. The maximum acceptable number is 17.

3. The section of the tape between 115 and 215 feet consistantly produces MFSE counts in excess of 17, being in the thousands in the 130-165 foot area; in the hundreds in the 165-195 foot area; and above 1000 in the 195-215 foot area.

TABLE 1

Record and Playback Test Operations of the WBVTR-1

Date	Orbit	Operation
April 11	3649	Record 7 scenes
	3651	Playback above
April 12	3663	Record 7 scenes
	3665	Playback above
April 13	3677	Record 8 scenes
	3679	Playback above
April 16	3719	Record 6 scenes
	3721	Playback above
	3721	Repeat playback above
April 17	3728	LAP WBVTR heads
April 17	3733	Record 6 scenes
	3735	Playback above
April 18	3746	Record 5 scenes
	3749	Playback above
April 19	3760	Record 5 scenes
	3763	Playback above



K+E 10 X 10 TO ½ INCH 46 1320
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

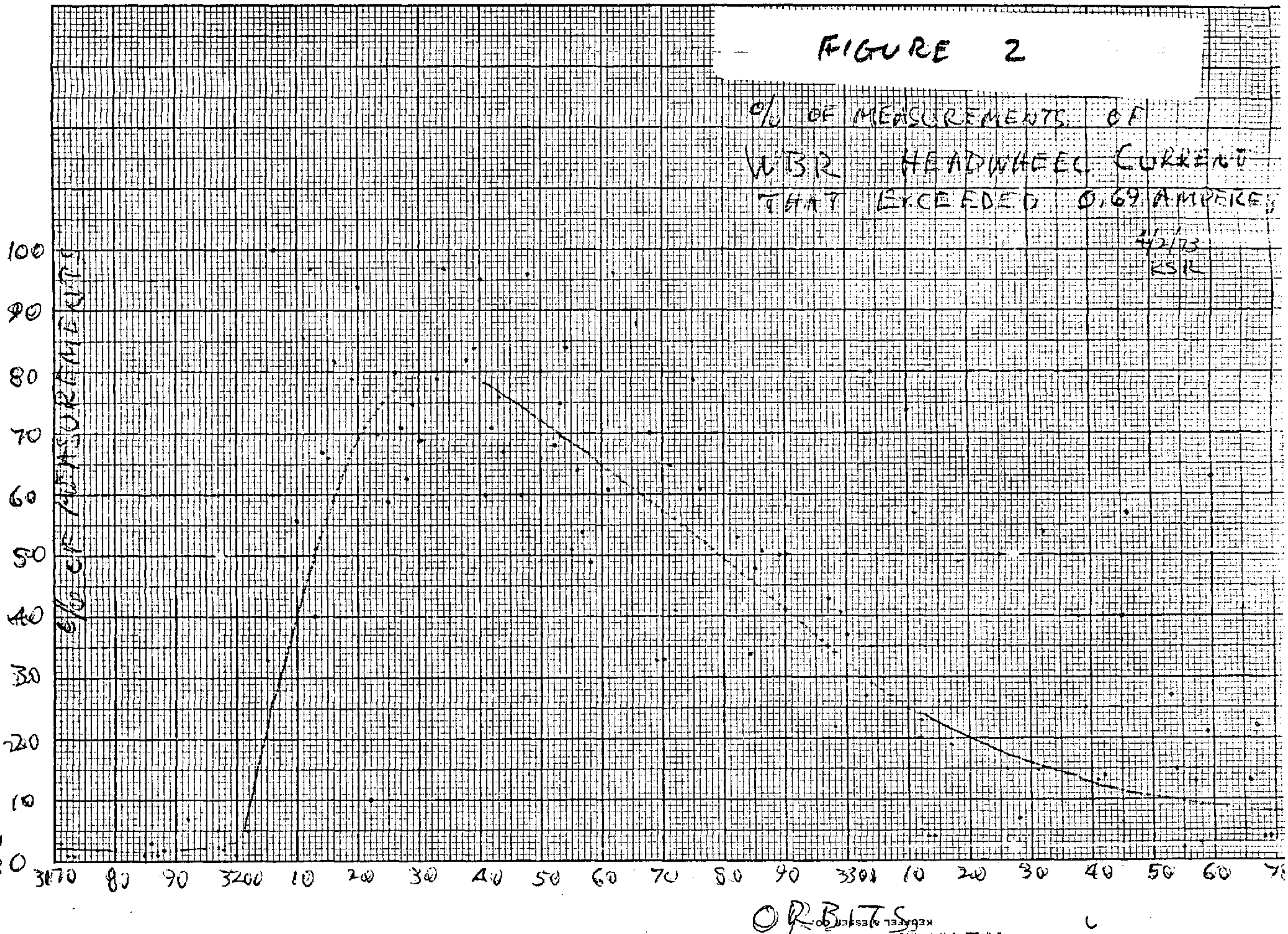
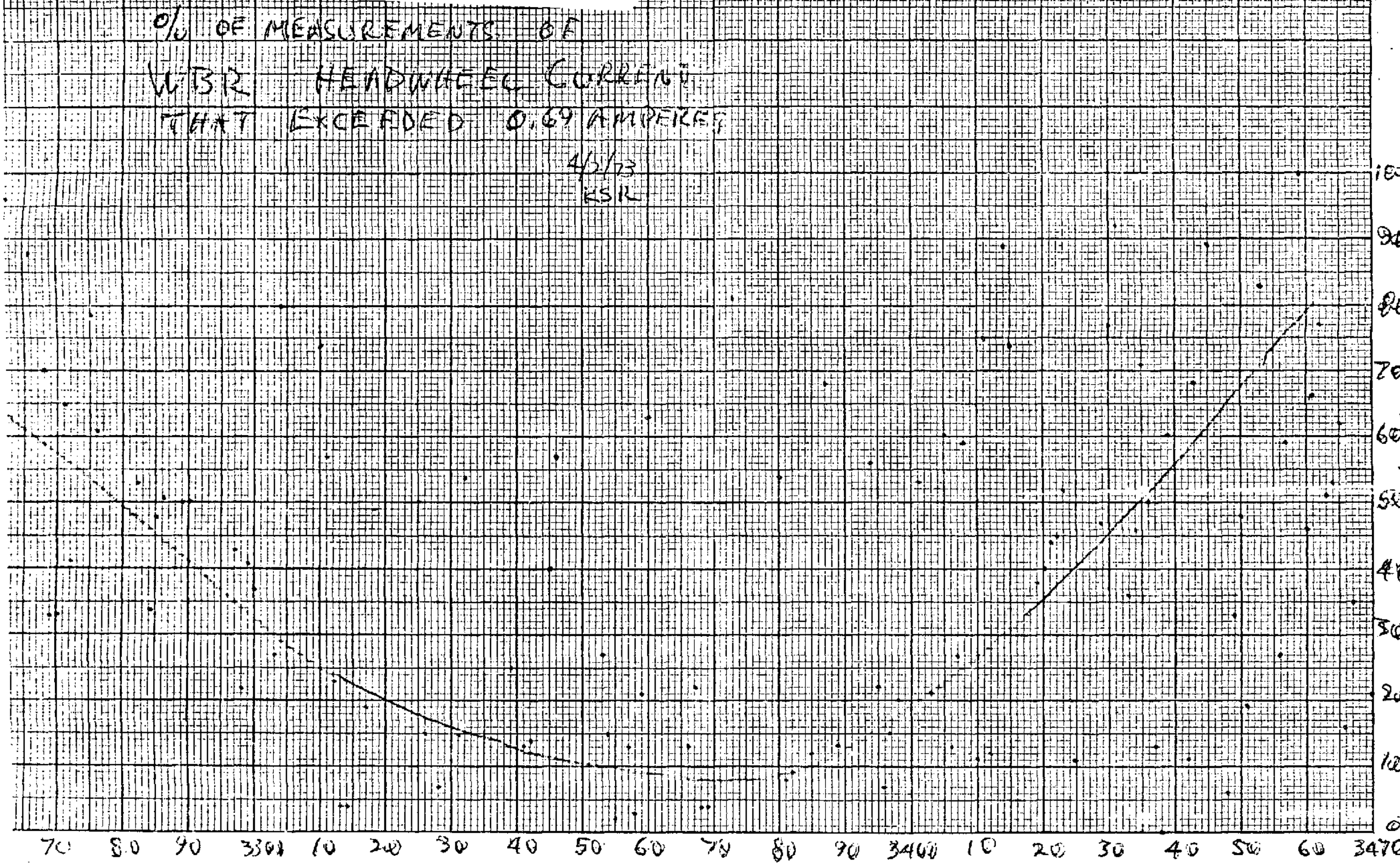


FIGURE 2
% OF MEASUREMENTS OF
WBR HEADWHEEL CURRENT
THAT EXCEEDED 0.69 AMPERES
4/5/73
KSK
% OF MEASUREMENTS
100
90
80
70
60
50
40
30
20
10
0
3170
80
90
3200
10
20
30
40
50
60
70
80
90
3300
10
20
30
40
50
60
ORBITS

FIGURE 2



ORBITS

GENERAL ELECTRIC
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FROM	TO
K.S. Rizk	Distribution

DATE SENT	DATE INFO. REQUIRED	PROJECT AND REQ. NO.	REFERENCE DIR. NO.
March 16, 1973			

SUBJECT

RECENT DCS INTERFERENCE

INFORMATION REQUESTED/RELEASED

INTRODUCTION

Since launch, the Data Collection System (DCS) has experienced ocassional interference of varying duration and intensity. Early periods of mild intensity and short duration were associated (see Memo 1H05-490 by J.E. Seitner) with transmissions by Nimbus 4 to ground-based IRLS, and to an unidentified transmitter southeast of Denver, Colorado. The two more recent periods of interference were the most severe (over 30% bad messages) and most prolonged (over 3 days). The first of these--November 29 to December 2, 1972--was attributed (see PIR-U-ITH4-ERTS-73 by K.S. Rizk) to ground equipment supporting the Apollo and Nimbus E launches.

The latest period of interference was the most severe (over 40% bad messages) and most prolonged (15 days). It began in Orbit 2898, about 13:40 GMT on February 16 and continued through Orbit 3102, about 0500 on March 3, 1973. For at least one orbit per day, the bad messages exceeded 70% of the total messages received. As abruptly as the interference started, it subsided, and the DCS resumed its normal rate of less than 5% bad messages.

OBJECTIVE OF THIS STUDY

The purpose of this study is to determine the geographic location of the source of these latest interfering signals.

SUMMARY

Plots of the geographic location of the spacecraft at peak times of interference indicate that the spacecraft passed through lobes of the radiation pattern of an interfering equipment. Four independent location techniques, including convergance of the lobes, and other characteristics of the field pattern of the interfering signals were used to fix with high confidence the location of the major interfering equipment at 33°N 101°W (±100 miles) adjacent to Abaline, Texas. Zones of continuous heavy interference (the AGC of the DCS receiver registered levels above -110 dbm) were experienced at the nearest approach of the spacecraft to the designated location of the source of interference.

T. W. Winchester
L. Smith-Code 430
E. Painter-Code 430
J. Seitner-U2112
J. Morakis-Code 752.A
J. Rogers
K. Rizk (4)

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In addition to this major source of interference, at least one 93-second period of interference can be ascribed to signals from the IRLS spacecraft transmitting on a frequency within the bandwidth of the DCS receiver while above and near the ERTS Spacecraft.

RECOMMENDATION

It is recommended that appropriate steps be taken to arrange with the operators of the interfering equipment some method for preventing recurrance of this interference.

DISCUSSION

On 16 February about 13:40 GMT during orbit 2898, a south-to-north night time pass over the eastern U.S., the percentage of DCS bad messages was 40%, up sharply from the customary level of about 5%. For the next 15 days, this severe interference was experienced. The interference existed on all orbits over the United States in which DCS data was collected, except for the two daily western-most DCS orbits. Figure 1 shows the percentage of bad messages received during this period of interference.

To identify the general geography where maximum interference occured, Table 1 was prepared. The first 3 columns list the date, the ground receiving station and the orbit number. The last three columns list the total number of messages the number of bad messages and the percentage of bad messages received. The middle four columns separate the orbits geographically by zones of longitude. This results in 8 geographic zones, through which night and day orbits pass during each day.

Figure 2 shows the geography of the early morning (GMT) night-time passes and Figure 3 similarly shows the geography of the day-time passes. The February 12 orbits transited the eastern edge of each zone. Each day's orbits moved successively westward about 1.3° per day from the track of the preceding day's orbit. For convenience, the orbits are grouped into families, each orbit in a family being separated from the next by 14 orbits. To avoid obscuring the geographical significance of the interference levels, Table 1 gives only Zone 3 orbits from February 27 through March 4, 1973.

the only orbits shown for [illegible]
Feb 27 thru March 4 [illegible]

Figures 4 through 11 show the DCS performance in each geographic zone sequentially. Zones 1 through 4 are night-time, south-to-north passes occuring in the early morning hours, Zone 1 passes occuring shortly after midnight GMT, and Zone 4 passes occuring before 0700 GMT. Zones 5 through 8 are day-time, north-to-south passes occuring between 1400 and 2200 GMT. One orbit a day transits each geographic zone.

In Zone 1 Figure 4 the percent of bad messages are seen to be generally below 10% before the interference started on 16 February. Thereafter, the interference level drifted upward toward 40% as the daily orbits moved westward, indicating that each day it moved nearer to the source of interference.

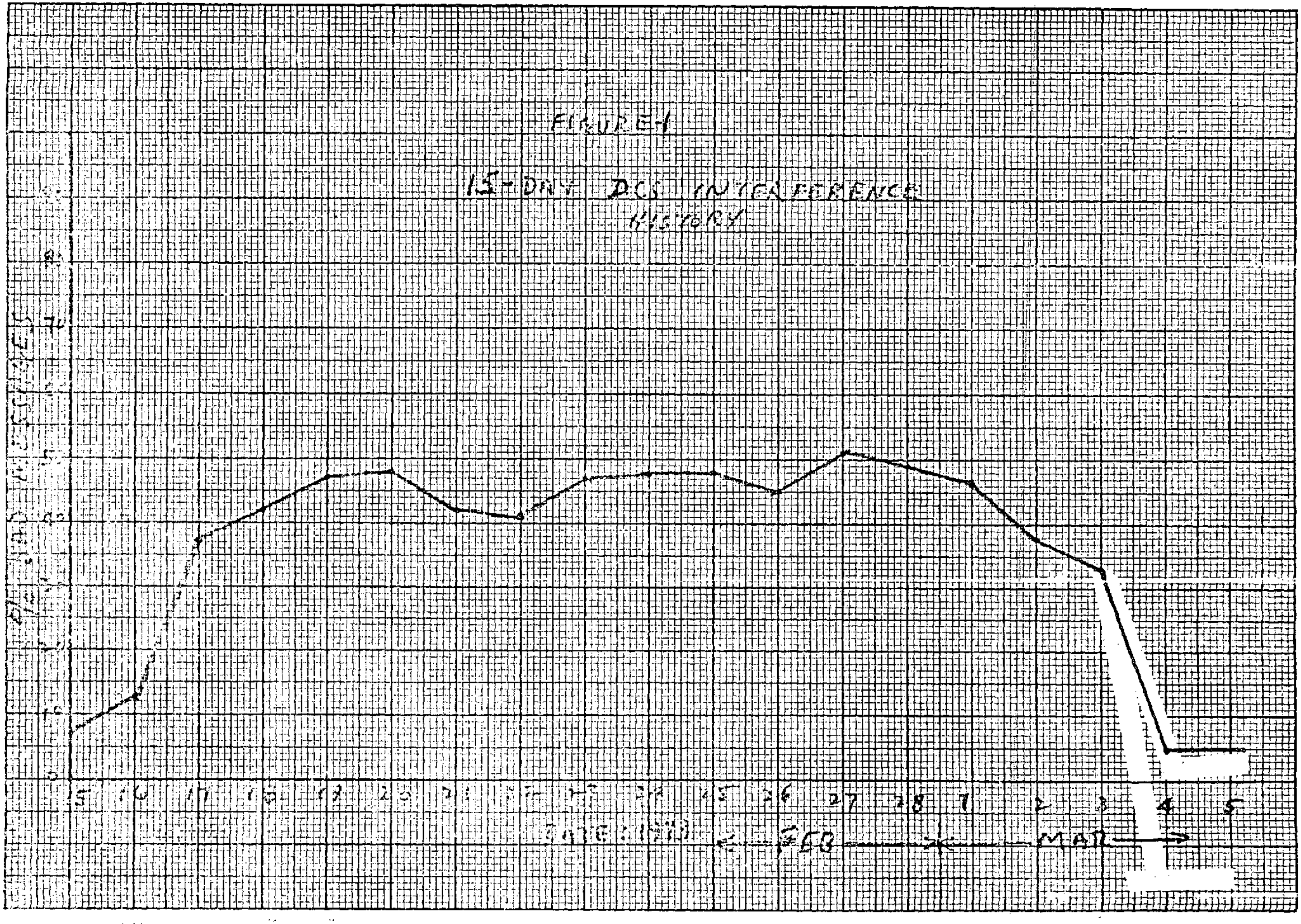


FIGURE-1
15-DAY DCS INTERFERENCE HISTORY
26
27
28
1
2
3
4
5
FEB
MAR

TABLE 1
DCS PERFORMANCE BY ORBITS

DATE	GND REC'V. STA.*	ORBIT NO.	ZONES 1/5	2/6	3/7	4/8	DCS MESSAGES Total	Bad	%Bad
			W. LONG. AT 38°N LAT.						
Feb. 12	N	2835	55				162	18	11
	N	2836		80			249	13	5
Day 043	G	2837			105		148	19	13
	G	2838				133	67	5	7
	N	2843	74				200	11	6
	N	2844					169	15	9
	G	2844			99		177	12	7
	G	2845				126	79	3	4
Feb. 13	N	2849	56				168	13	8
	N	2850		82			254	17	7
Day 044	G	2851			108		136	9	7
	G	2852				133	63	5	8
	N	2857		76			229	17	7
	N	2858			101		146	12	8
	G	2858					172	9	5
	G	2859				127	70	6	9
Feb. 14	N	2863	57				66	6	9
	N	2864		83			261	12	5
Day 045	G	2865			109		136	10	7
	G	2866				135	61	7	11
	N	2870	52				86	8	14
	N	2871		77			221	7	3
	N	2872			103		153	13	9
	G	2872					174	13	7
	G	2873				128	82	12	15
Feb. 15	N	2877	59				196	7	4
	N	2878		85			265	18	7
Day 046	G	2879			110		124	8	6
	G	2880				137	60	6	10
	N	2884	52				91	5	6
	N	2885		78			233	17	7
	N	2886			104		133	17	13
	G	2886					182	17	9
	G	2887				130	83	9	11
Feb. 16	N	2891	61				192	14	7
	N	2892		86			263	17	6
Day 047	G	2893			112		122	8	7
	** G	2894				138	57	3	5
	N	2898	54				80	29	40
	N	2899		80			170	39	23
	N	2900			106		93	21	23
	G	2900					118	22	19
	G	2901				131	68	2	3

* N = Greenbelt; G = Goldstone
** Start of interference

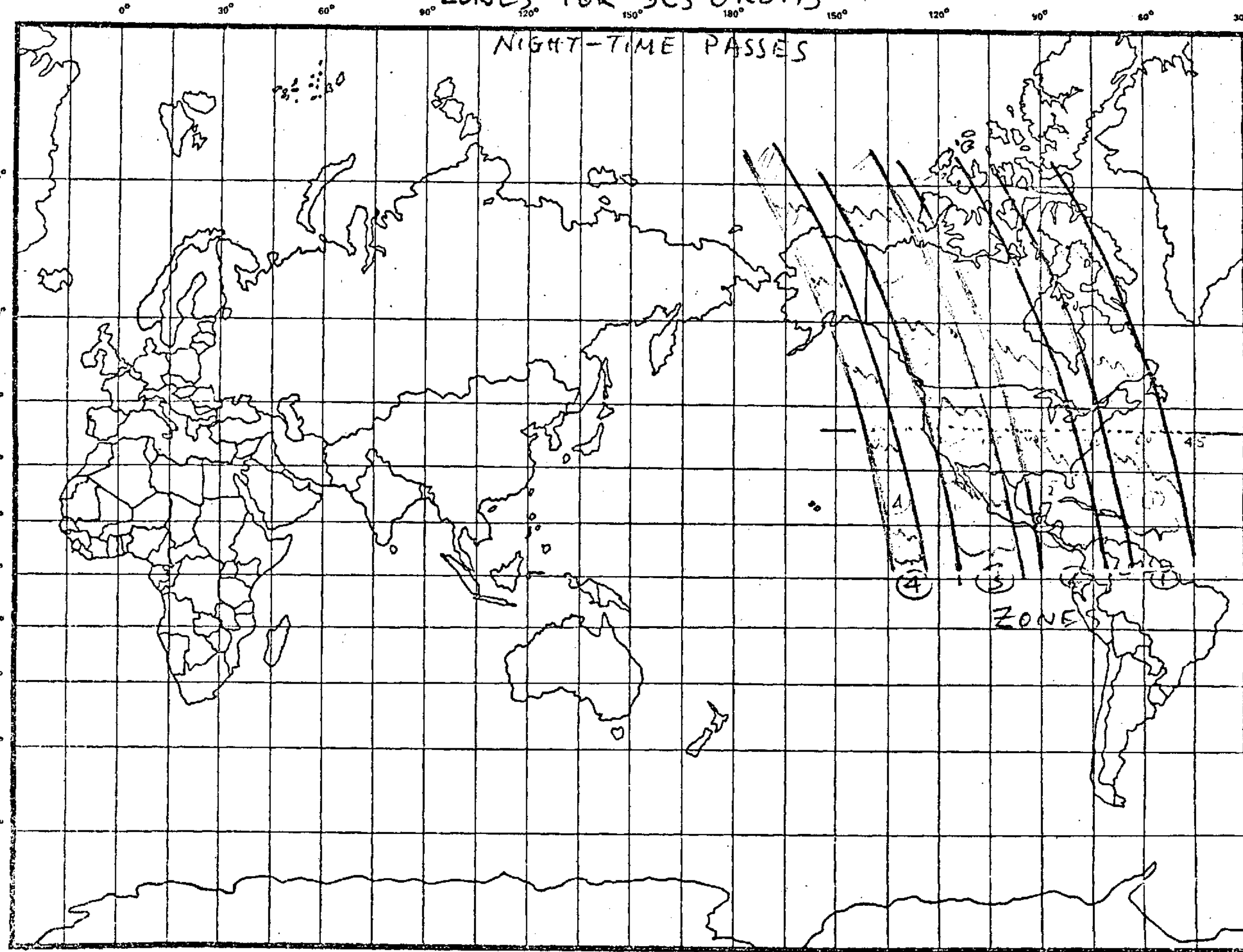
DATE	GND REC'V. STA.	ORBIT NO.	ZONES 1/5	2/6	3/7	4/8	DCS MESSAGES Total	Bad	%Bad
			W. Long. AT 38°N LAT.						
Feb. 17	N	2905	61				109	16	15
	N	2906		88			168	60	36
Day 048	G	2907			113		91	6	7
	G	2908				139	40	2	5
	N	2912	56				84	28	33
	N	2913		81			154	26	17
	G	2914			107		303	236	78
	G	2915				133	37	0	0
Feb. 18	N	2919	63				199	57	29
	N	2920		89			132	47	36
Day 049	G	2921			115		267	189	71
	G	2922				141	38	2	5
	N	2926	57				131	37	28
	N	2927		83			169	42	25
	G	2928			108		230	158	69
	G	2929				134	43	0	0
Feb. 19	N	2933	65				205	54	26
	N	2934		90			135	33	24
Day 050	G	2935			116		287	221	77
	G	2936				142	26	2	8
	N	2940	58				128	33	26
	N	2941		84			132	39	30
	G	2942			110		267	191	72
	G	2943				136	41	1	2
Feb. 20	N	2947	66				195	31	16
	N	2948		92			153	57	37
Day 051	G	2949			118		153	84	55
	N	2954	60				175	64	37
	N	2955		85			132	25	19
	G	2956			111		361	305	85
	G	2957				137	65	33	51
Feb. 21	N	2961	67				214	36	17
	N	2962		94			167	31	19
Day 052	G	2963			119		106	41	39
	N	2968	61				128	26	20
	N	2969		87			105	21	20
	G	2970			113		381	320	84
	G	2971				138	36	3	8
Feb. 22	N	2975	69				174	43	25
	N	2976		95			103	25	24
Day 053	G	2977			121		128	52	40
	N	2982	62				145	34	23
	N	2983		89			97	22	23
	G	2984			114		277	211	76
	G	2985				140	42	16	38

DATE	GND REC'V. STA.*	ORBIT NO.	ZONES 1/5	2/6	3/7	4/8	DCS MESSAGES Total	Bad	%Bad
			W. Long. AT 38°N LAT.						
Feb. 23	N	2989	71				258	73	28
	G	2990		96			312	205	66
Day 054	G	2991			122		73	1	1
	N	2996	64				143	23	16
	N	2997		90			154	36	23
	G	2998			116		385	312	81
	G	2999				142	40	1	3
Feb. 24	N	3003	72				211	41	19
	G	3004		98			285	210	73
Day 055	G	3005			123		83	3	4
	N	3010	65				167	42	30
	N	3011		91			381	151	40
	G	3011					206	64	31
	G	3012			117		175	87	50
	G	3013				143	37	2	5
Feb. 25	N	3116	47				117	44	38
	N	3017	73				205	38	19
Day 056	G	3018			100		359	280	78
	G	3019				125	76	1	1
	N	3024	67				179	33	18
	N	3025		93			177	44	25
	G	3025					247	152	62
	G	3026				118	280	210	75
Feb. 26	N	3030	49				144	66	46
	N	3031		75			235	52	22
Day 057	G	3032			101		231	143	62
	G	3033				127	81	6	7
	N	3038	69				170	32	19
	N	3039		94			146	22	15
	G	3039					297	206	69
	G	3040				120	244	178	73
Feb. 27 Day 058		3046			102		438	325	74
Feb. 28 Day 059		3060			103		365	268	73
Mar. 1 Day 060		3074			105		340	256	75
Mar. 2 Day 061		3088			106		477	379	79
Mar. 3 Day 062 *		3102			108		396	295	74

* End of interference

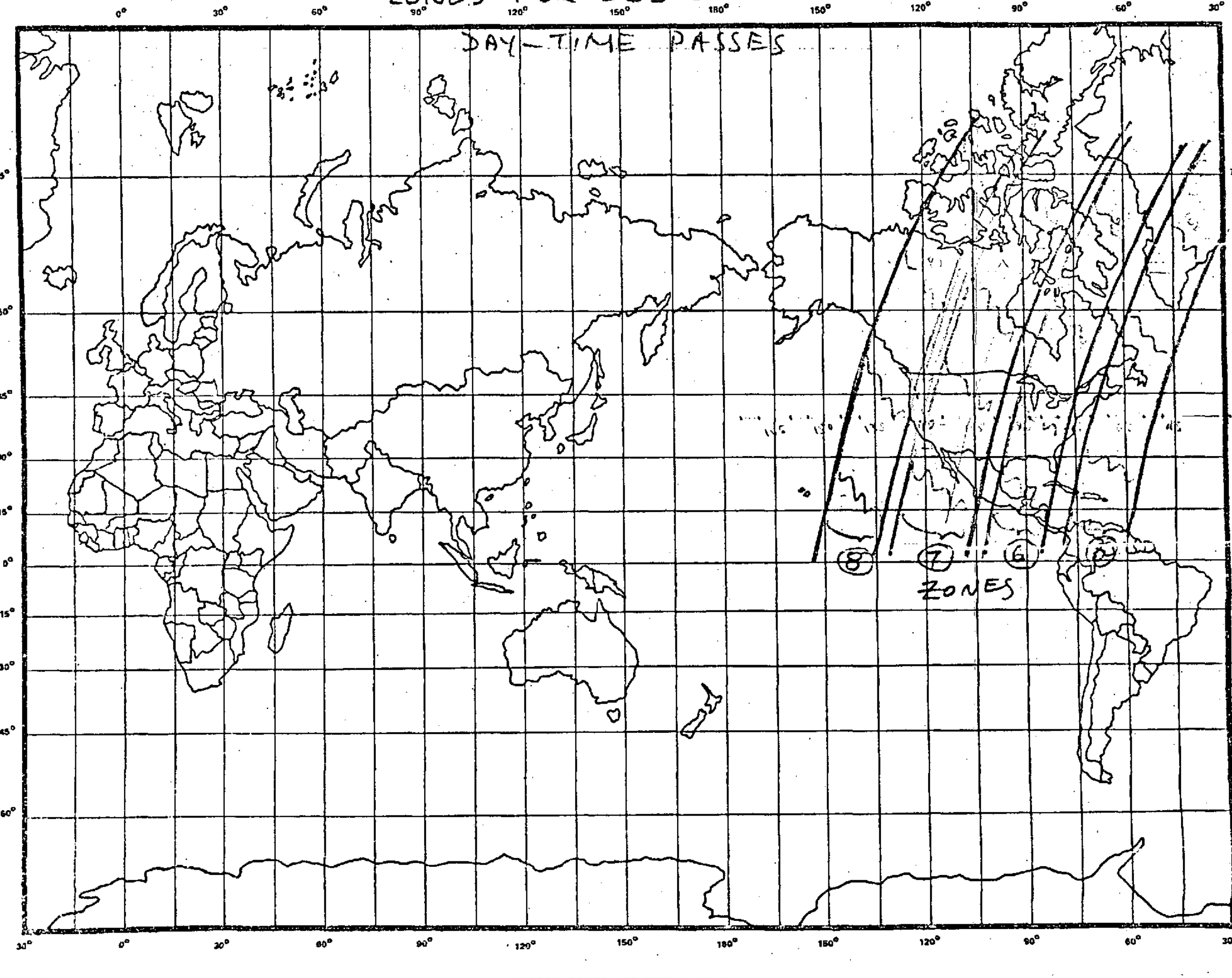
Mar. 4 Day 063	3116	109	117	4	3

FIGURE 2
ZONES FOR DCS ORBITS



WORLD COVERAGE OUTLINE MAP

FIGURE 3
ZONES FOR DCS ORBITS



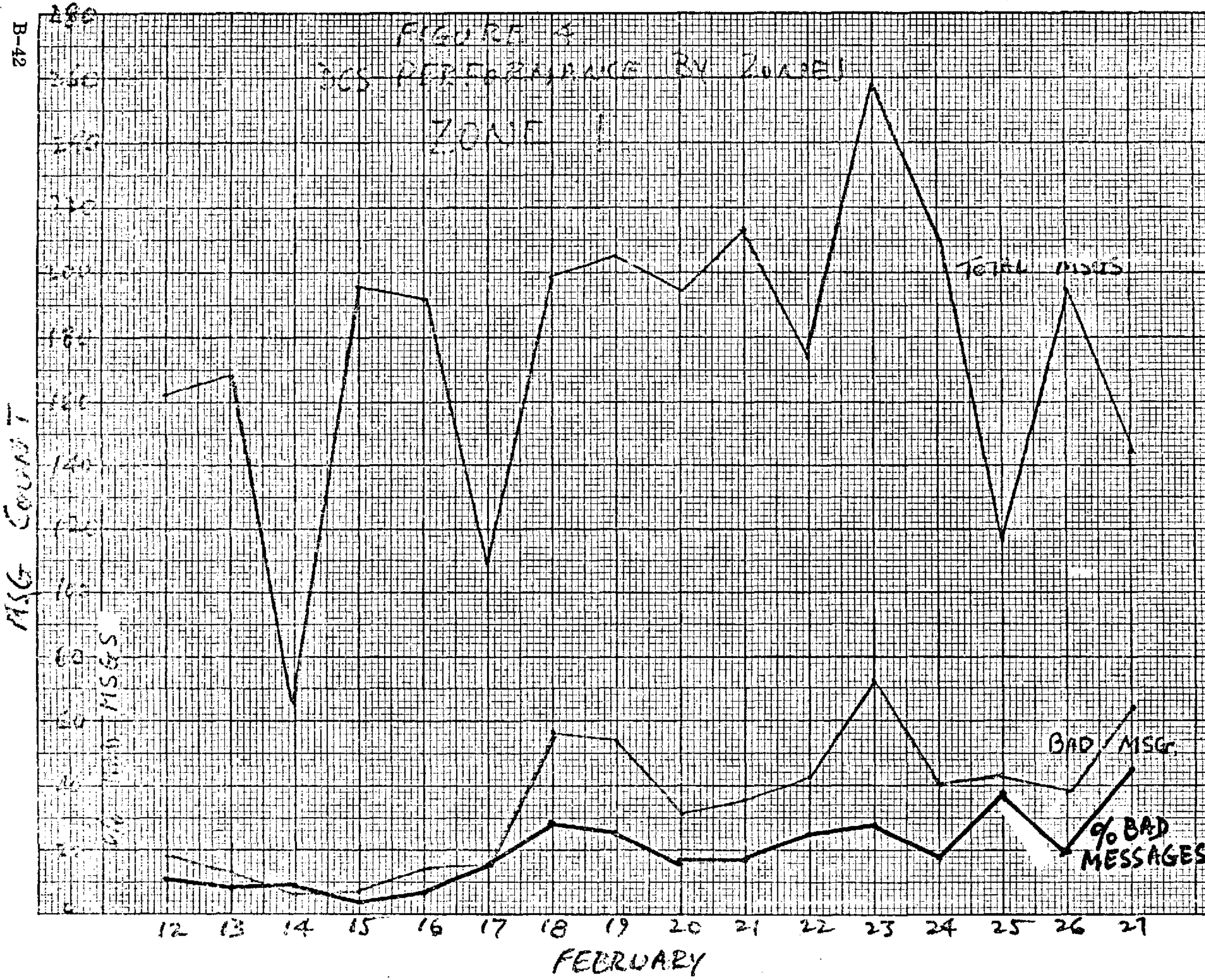


FIGURE 4
DCS PERFORMANCE BY ZONE
ZONE 1
MSG COUNT
MSGS
TOTAL MSGS
BAD MSG.
% BAD
MESSAGES
12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
FEBRUARY

In Zone 2 Figure 5 the same rise in interference level is again apparent with orbit movement westward. On February 25, the westward movement had carried the daily orbit out of Zone 2 into Zone 3. There was no Zone 2 orbit that day. On day 26, an orbit from the preceding family entered Zone 2 at its eastern extremity which explains why the interference level dropped to its level in the February 16/17 era.

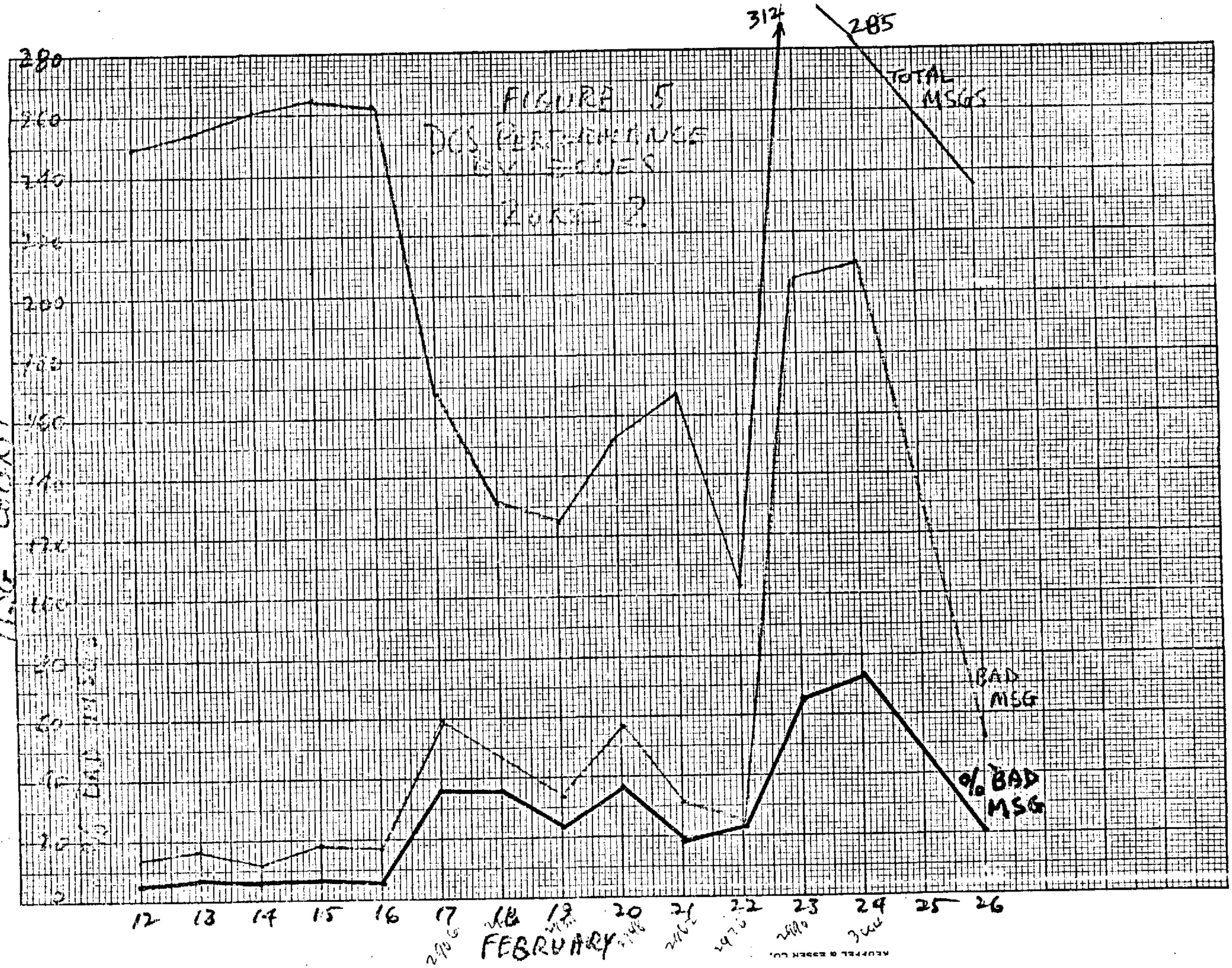
In Zone 3 Figure 6 it can be seen that in the pre-interference era, the message count dropped daily. When the interference began, the message count, the bad messages and the percent of bad messages rose sharply; and then declined as the orbit continued stepping westward, indicating it was receding from the interference source. The sharp rise again after the 24th of February was due to the fact that the prior Zone 3 orbit had stepped to the westward out of the Zone, and an orbit from the preceding orbit family approached the eastern extremity the high percent of bad messages indicating that the interference source was nearer the eastern rather than the western end of the Zone. In Figure 6, the DCS performance is extended through March 2, because it was becoming apparent that this family of orbits eventually passed over the interfering source. For these orbits from February 25 through March 2, it can be seen the percent of bad messages generally exceeded 70%.

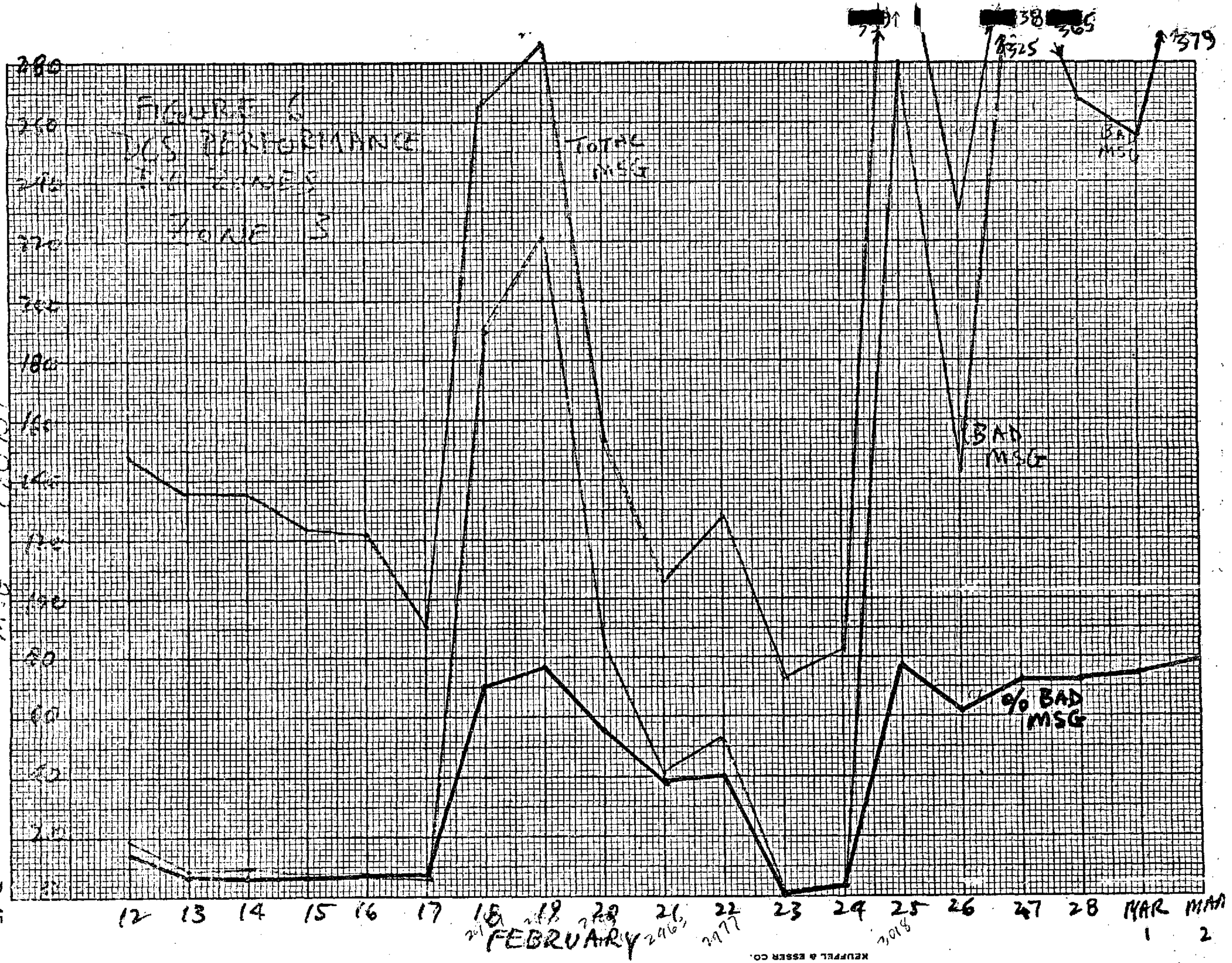
In Zone 4 Figure 7 it can be seen that no appreciable interference occured. The total message count declined as each days orbit moved to the west, receding from the DCS platforms and ground receiving stations. The orbit family moved out of range to the west on February 20, and an orbit from the preceding orbit family entered the eastern edge of the Zone on February 25, upon which the message count rose abruptly.

In Zone 5, Figure 8, the first of the day-time north-to-south passes, the effect of the interference can be seen by the abrupt rise in percent of bad messages on February 16, but there appears to be no significant trend in percent of bad messages with orbital westward movement. This is a characteristic of signal strength from low elevation angles--large distances--indicating the source was not near.

In Zone 6, Figure 9, again the sudden effect of the interference can be seen by the percent of bad messages rising to 23% on February 16, from a level of 7% on the prior day. The total number of messages received declined as the orbital westward stepping carried the spacecraft away from Greenbelt, the ground receiving station. Continued movement of the orbit westward, however, brought the Goldstone ground station within range on February 24. On February 25, most of the messages were received by Goldstone. The spacecraft position was now such that the percent of bad messages rose sharply from a level of 20% to over 60%. Such steep rises are characteristic of nearness to the source of interference. The reason for the isolated peak in the Greenbelt performance data on February 24 is not immediately apparent, and is the subject of continuing study.

In Zone 7, Figure 10, the effect of the interference is immediate, and large. The percent of bad messages remained daily in the vicinity of 80%. With westward movement of the daily orbit, Greenbelt received no more messages after February 16, when the interference had just begun. After February 23, the westward movement appeared to be carrying the spacecraft away from the interference


312
285
280
TOTAL MSGS
BAD MSG
% BAD MSG
MSG COUNT
12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
FEBRUARY


[redacted]
379
TOTAL MSG
BAD MSG
% BAD MSG
280
180
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
MAR 1
MAR 2
FEBRUARY

B-46

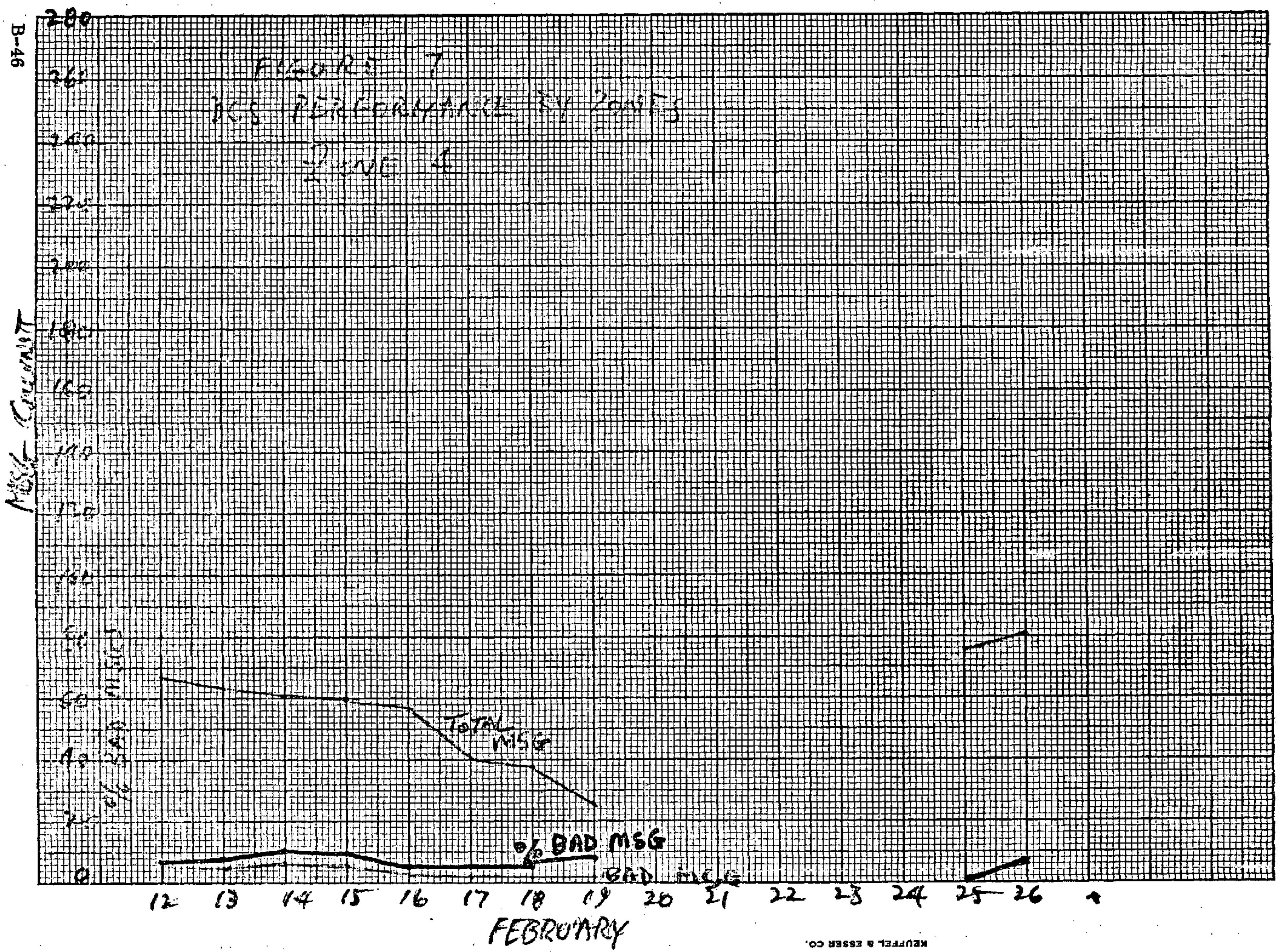


FIGURE 7
MSG COUNT
TOTAL MSG
% BAD MSG
BAD MSG
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
FEBRUARY

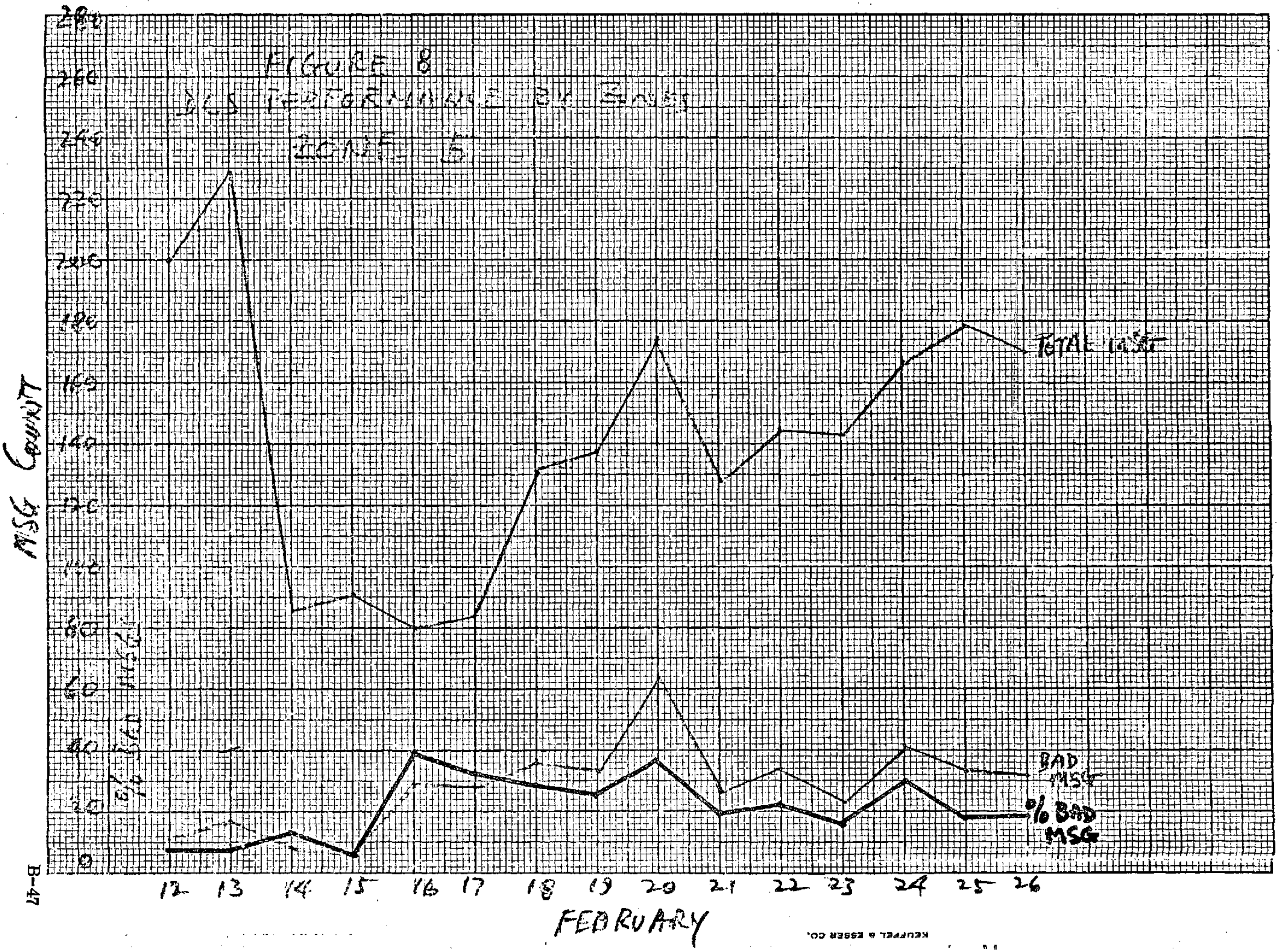


FIGURE 8
DCS PERFORMANCE BY ZONES
ZONE 5
MSG COUNT
% BAD MSG
TOTAL MSG
BAD MSG
% BAD MSG
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
FEBRUARY

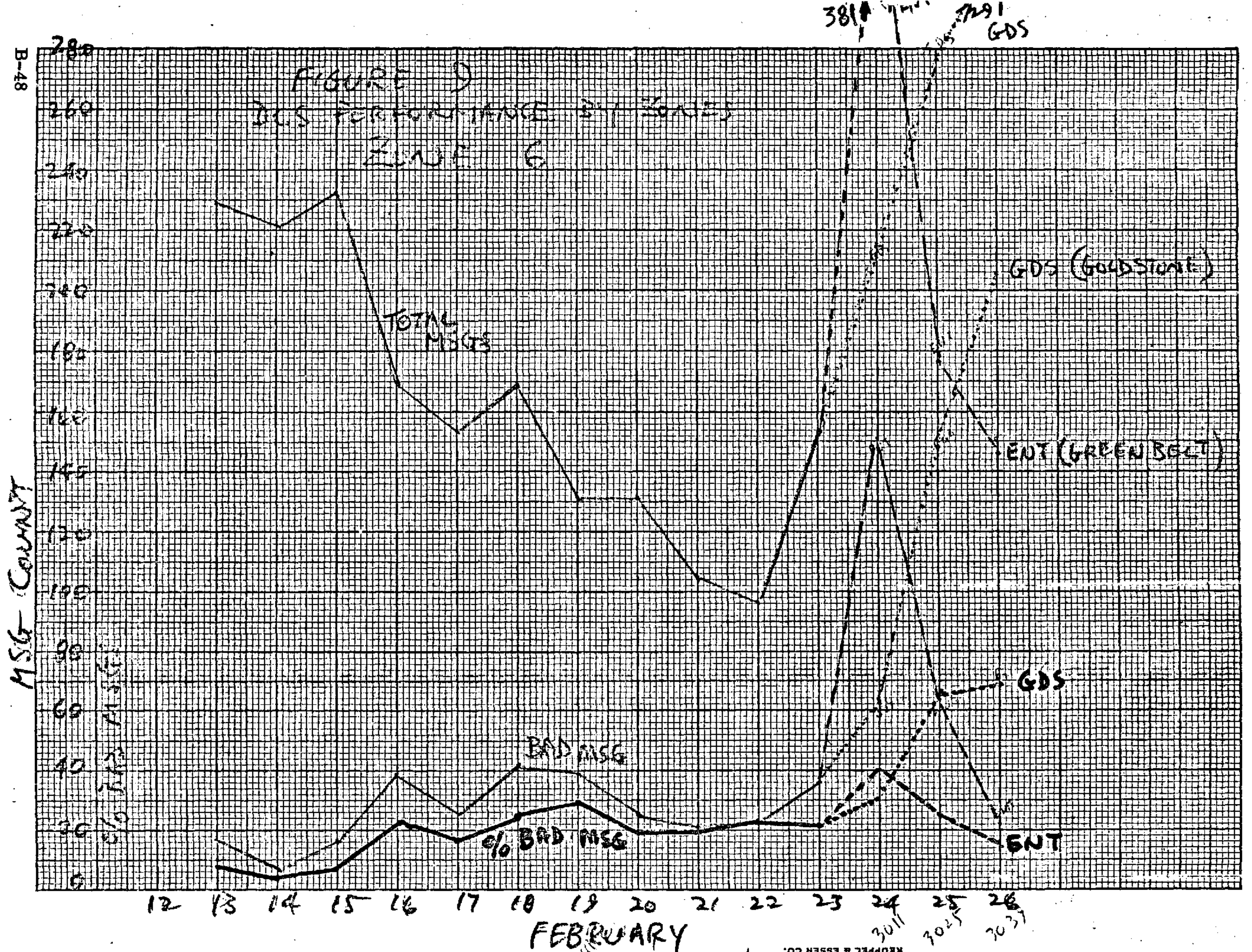


FIGURE 9
DCS PERFORMANCE BY ZONES
ZONE 6
TOTAL MSGS
BAD MSG
% BAD MSG
GDS (GOLDSTONE)
ENT (GREENBELT)
GDS
ENT
381
MSG COUNT
FEBRUARY
12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

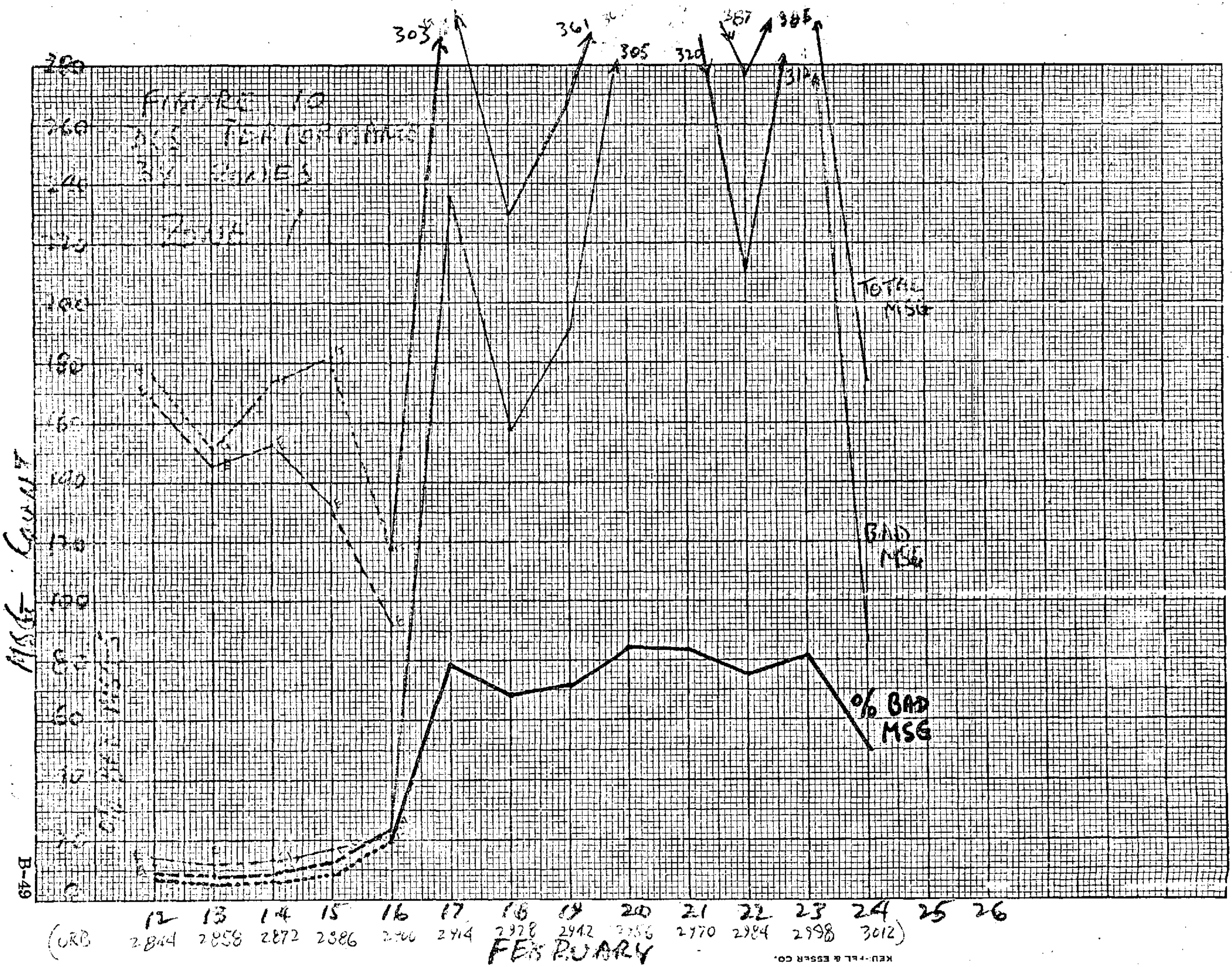


FIGURE 10
TOTAL MSG
BAD MSG
% BAD MSG
MSG COUNT
303
361
305
320
387
388
318
12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
(ORB 2844 2858 2872 2886 2900 2914 2928 2942 2956 2970 2984 2998 3012)
FEBRUARY

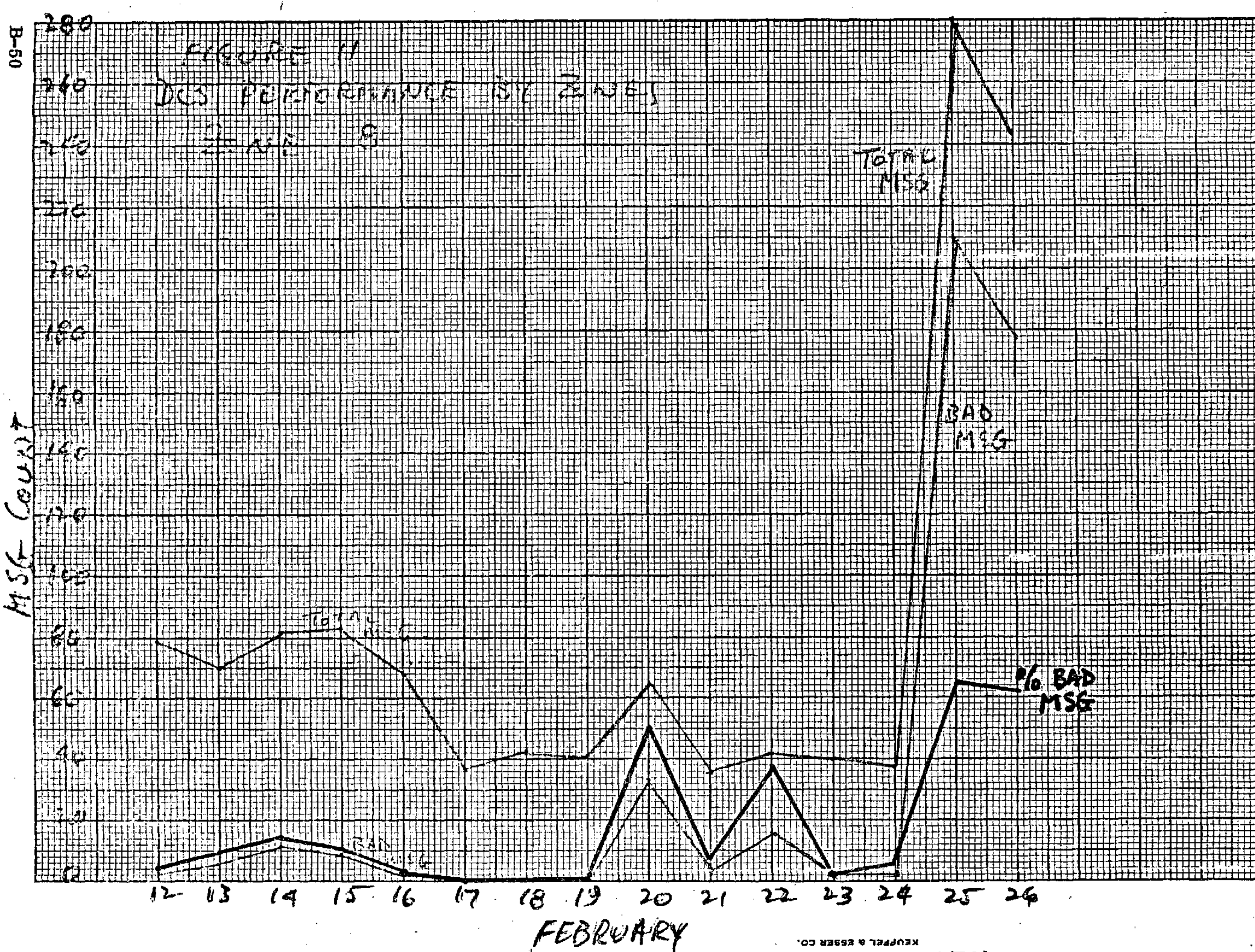


FIGURE 11
DCS PERFORMANCE BY ZONES
ZONE 9
TOTAL MSG
BAD MSG
% BAD MSG
MSG COUNT
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
FEBRUARY

source, and the percent of bad messages declined 25% in successive passes of this family of orbits. Again the steepness is characteristic of proximity to the source.

In Zone 8, Figure 11, no effect on the DCS performance is seen at the onset of the interference on February 16. Peaks on February 20 and 22 are unexplained and on February 25 and 26 a large change occured in the percent of bad messages There appears to be no relation to the prior interference and is the subject of continuing investigation.

From the above analysis, the orbits of interest appear to be those in Zones 2, 3, 6 and 7. To study in greater detail the DCS performance in these Zones, the AGC levels in the spacecraft DCS receiver were examined. These values are sampled every 16 seconds and read out by telemetry. It is therefore possible to plot these samples for the duration of each DCS station pass.

Figures 12 through 16 are plots of these values for the Zone 2 orbits. They show the time--and hence the geographic location--when the maximum signal strength was being received. These times are indicated by arrows along the time scale. Values from only 5 of these 15 days of interference are plotted, sufficient for the purpose.

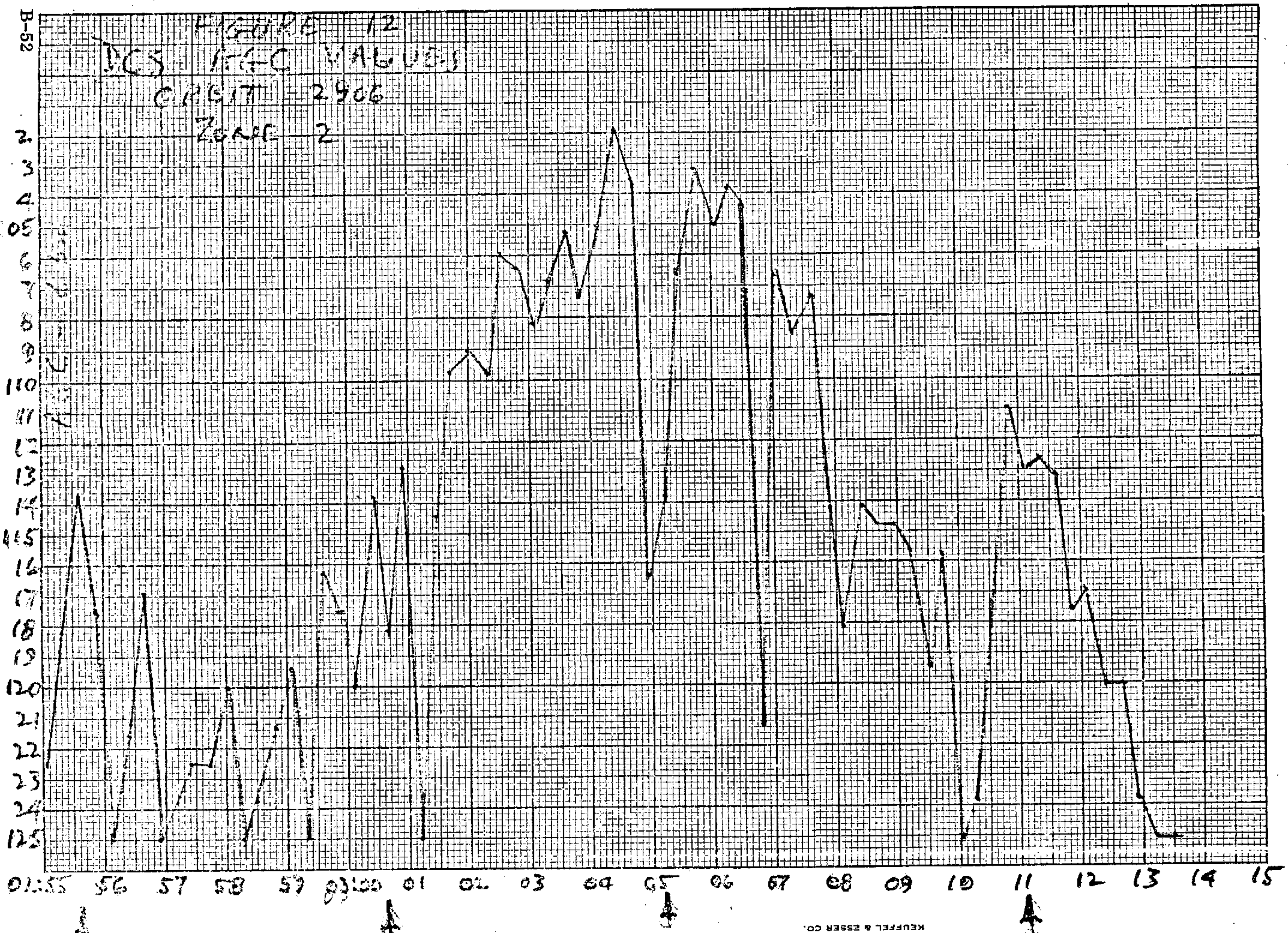
On February 17, in Figure 12, the first period of interference for this orbit family, the signal is seen to be very high. It reached a peak of -102 dbm, and remained essentially above -110 dbm for six minutes. The quiescent receiver registers -125 dbm.

On February 18, Figure 13, the AGC reached the record peak of -97.5 dbm, and remained above -110 dbm for essentially 7 minutes.

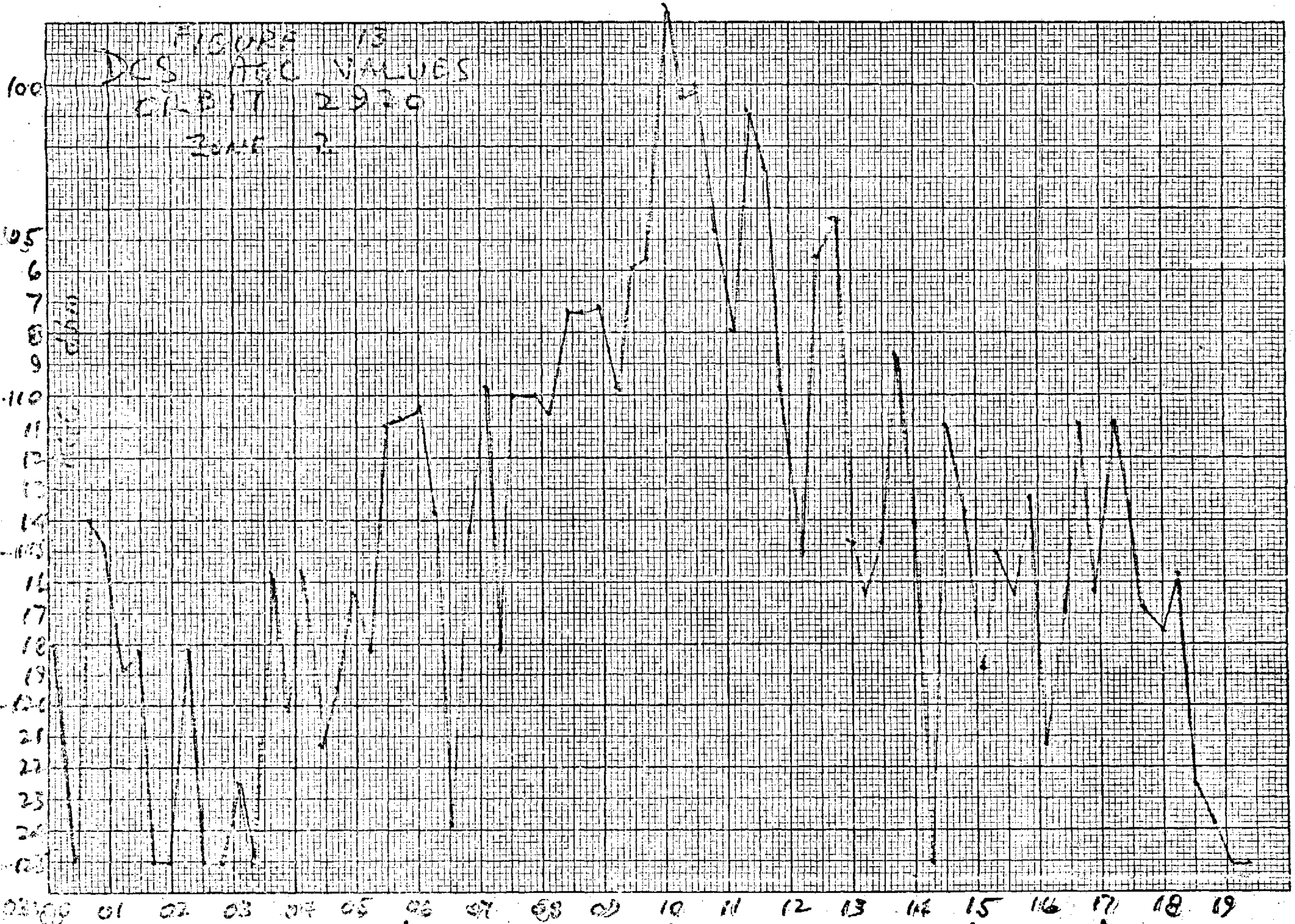
From this record peak signal, the subsequent daily passes of this orbit family in Zone 2 steadily declined as can be seen in Figures 14, 15 and 16. The peak AGC declined to -104, -107 and -107 dbm respectively; while the duration of the period above -110 dbm declined to 5.5, 5 and 2 minutes respectively. In addition more discrete cyclic effects are visible in the AGC plots as the orbit family stepped to the west, characteristic of a weakening field, or multipath propagation.

Figures 17 through 21 are plots of AGC values for the Zone 3 orbits. The peak AGC signals registered are all 15 to 20 dbm below the peaks registered in Zone 2 orbits. The peak increases from a value of -116.3 dbm on February 18 to -115.7 dbm on February 19, and thenceforth declined to a value of -118.1 on February 22, when the orbit family is near its western extremity. Times of AGC maximums are marked on the time scale.

Figures 22 through 24 are plots of AGC values for the Zone 6 orbits. On February 24, 25 and 26, the peak AGC levels reached were -103.1, -102.4 and -105.3 dbm respectively. The periods the AGC value was above -110 dbm were 4.5, 4.5 and 1.3 minutes respectively. Times of AGC maximums are marked on the time scale.

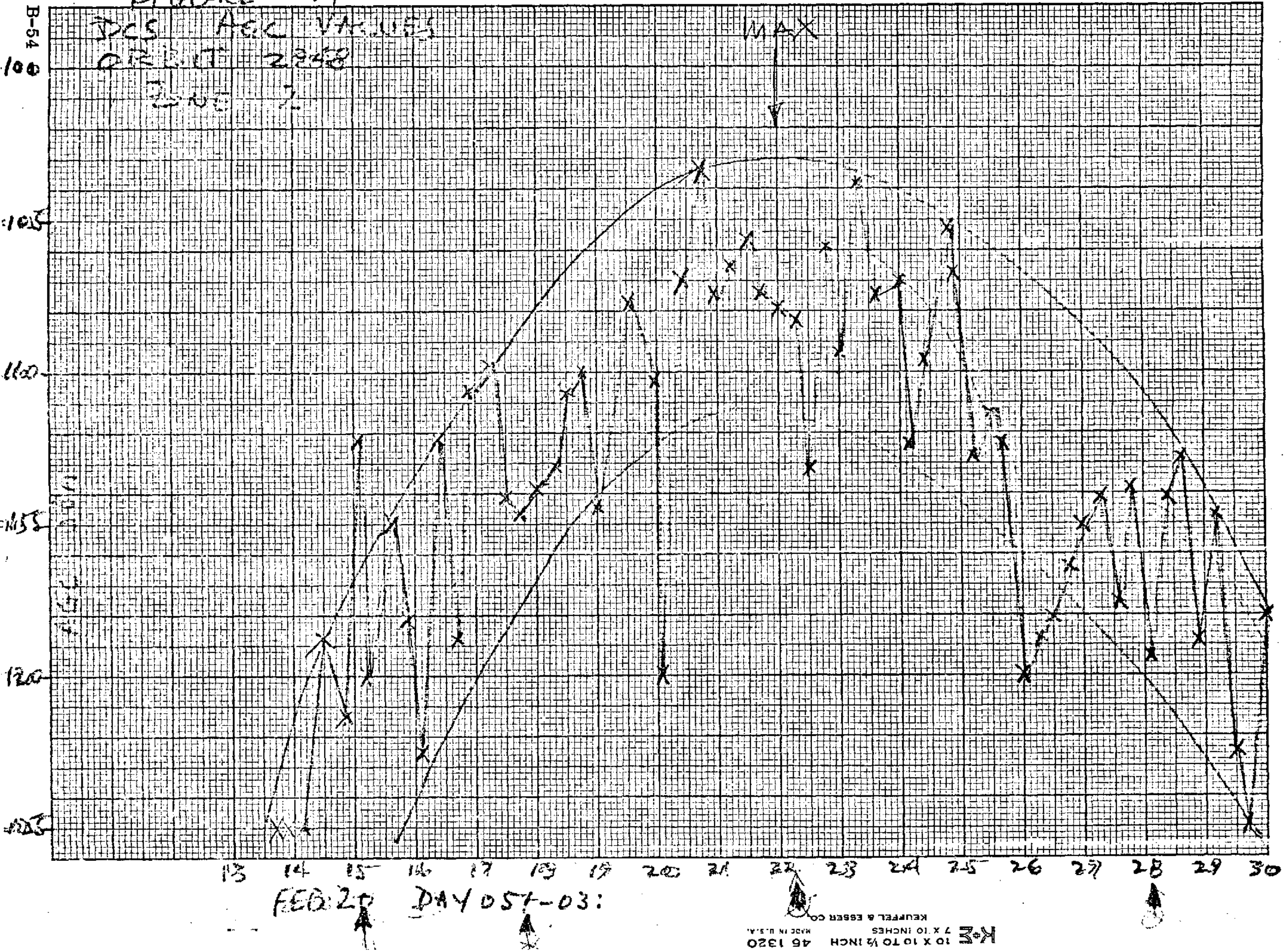


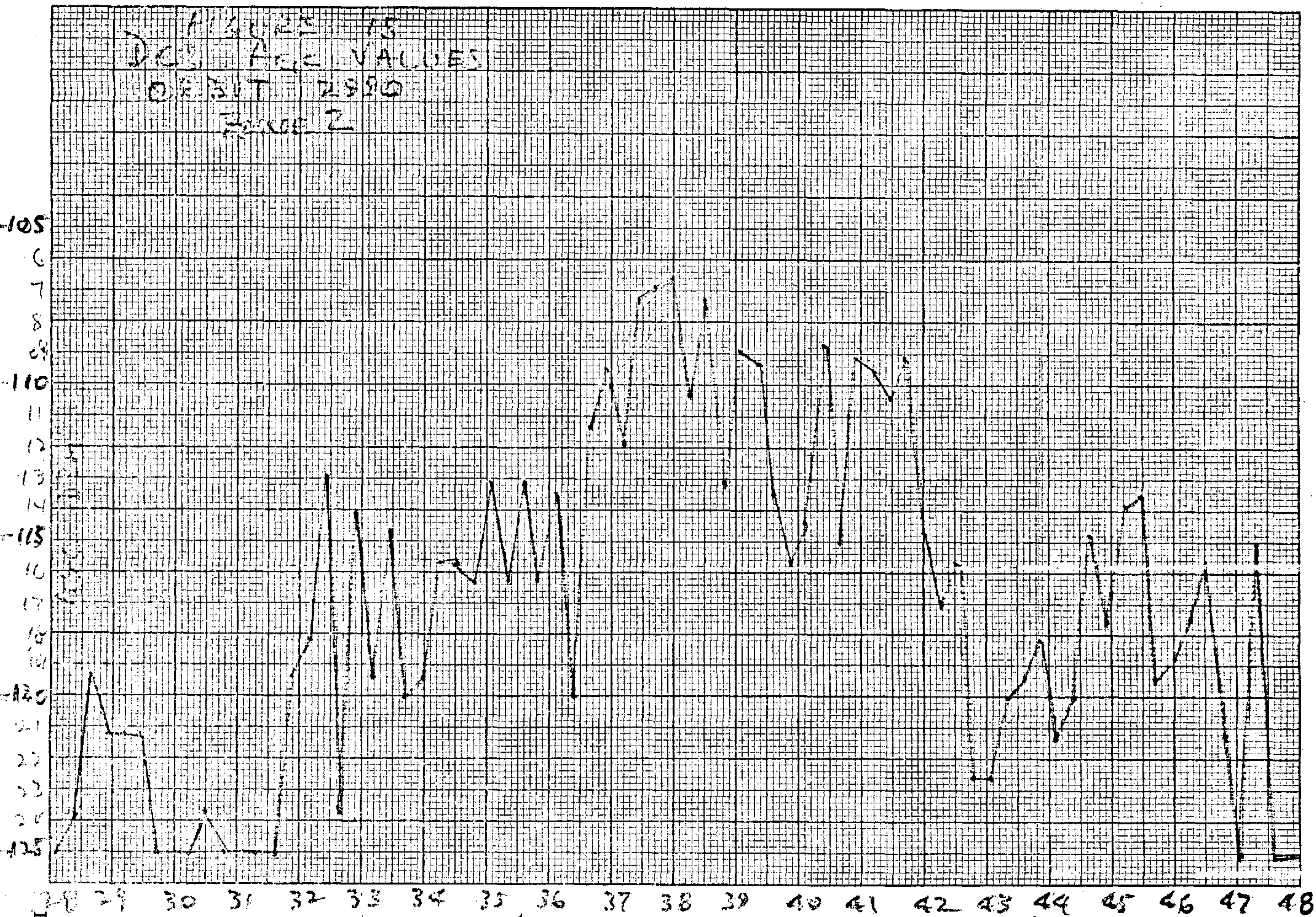
FEB 17 – DAY 048



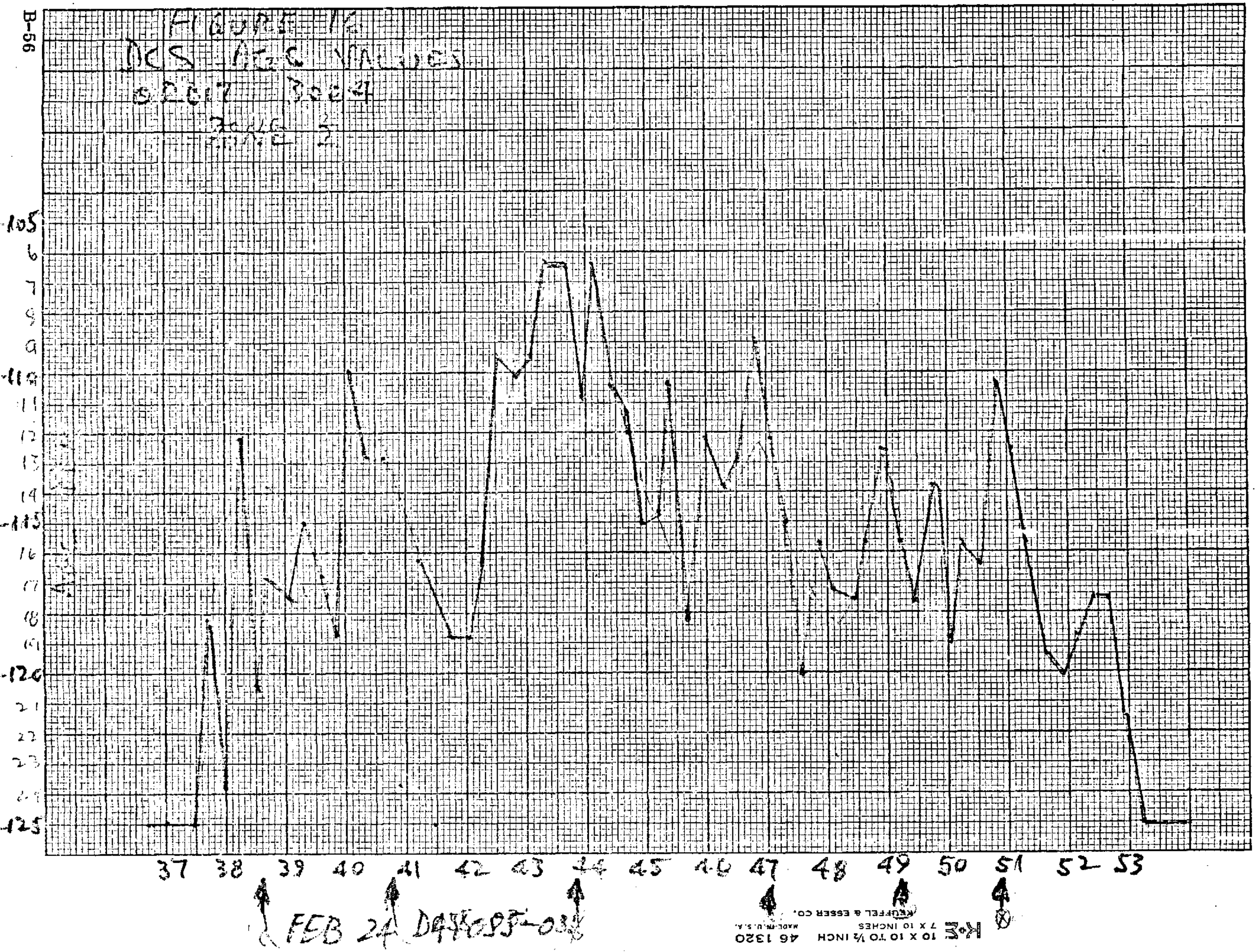
FEB 18 - DAY 049

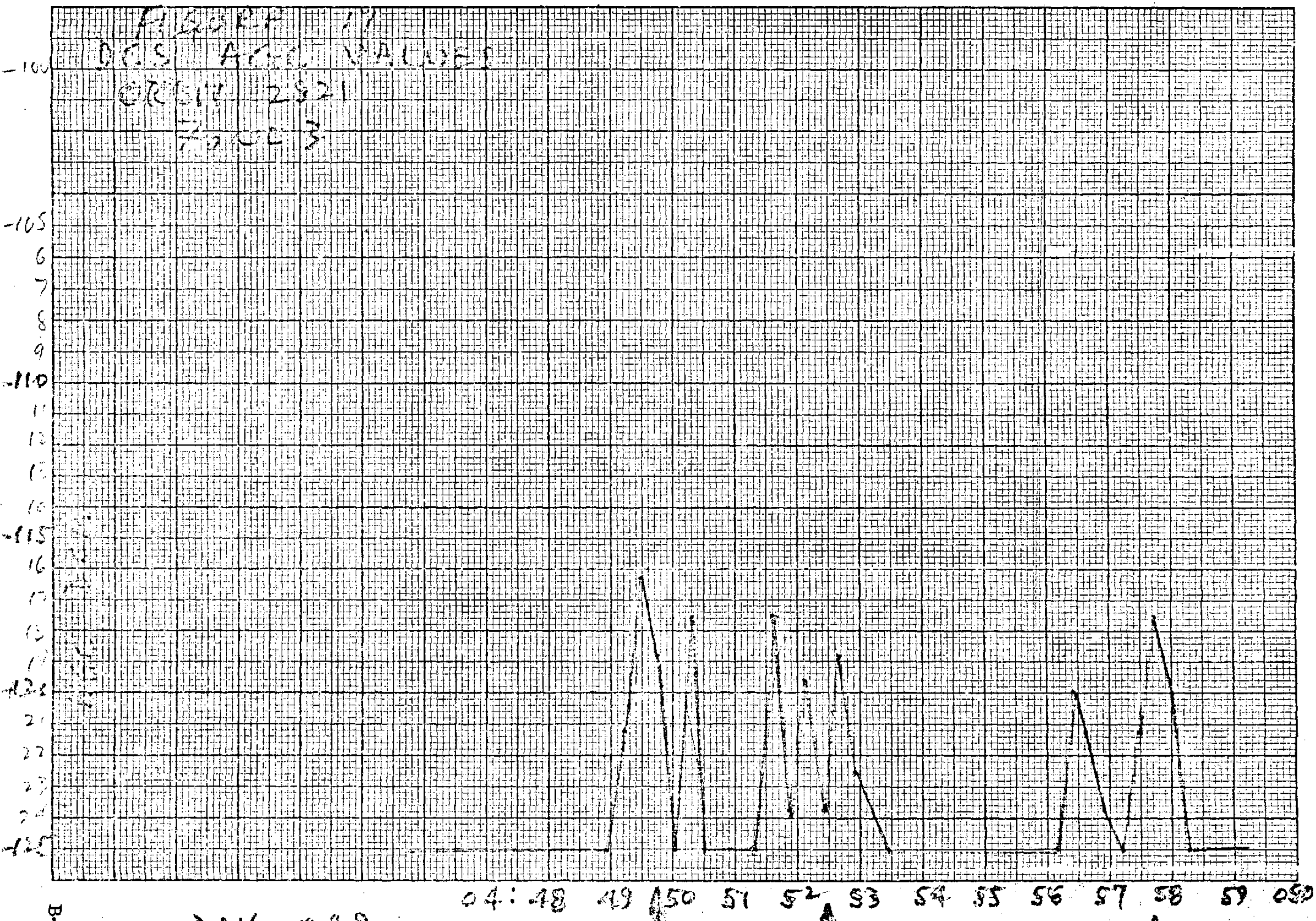
FIGURE 14


DCS AGC VALUES
MAX
100
105
110
115
120
125
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
FEB 20 DAY 051-03:

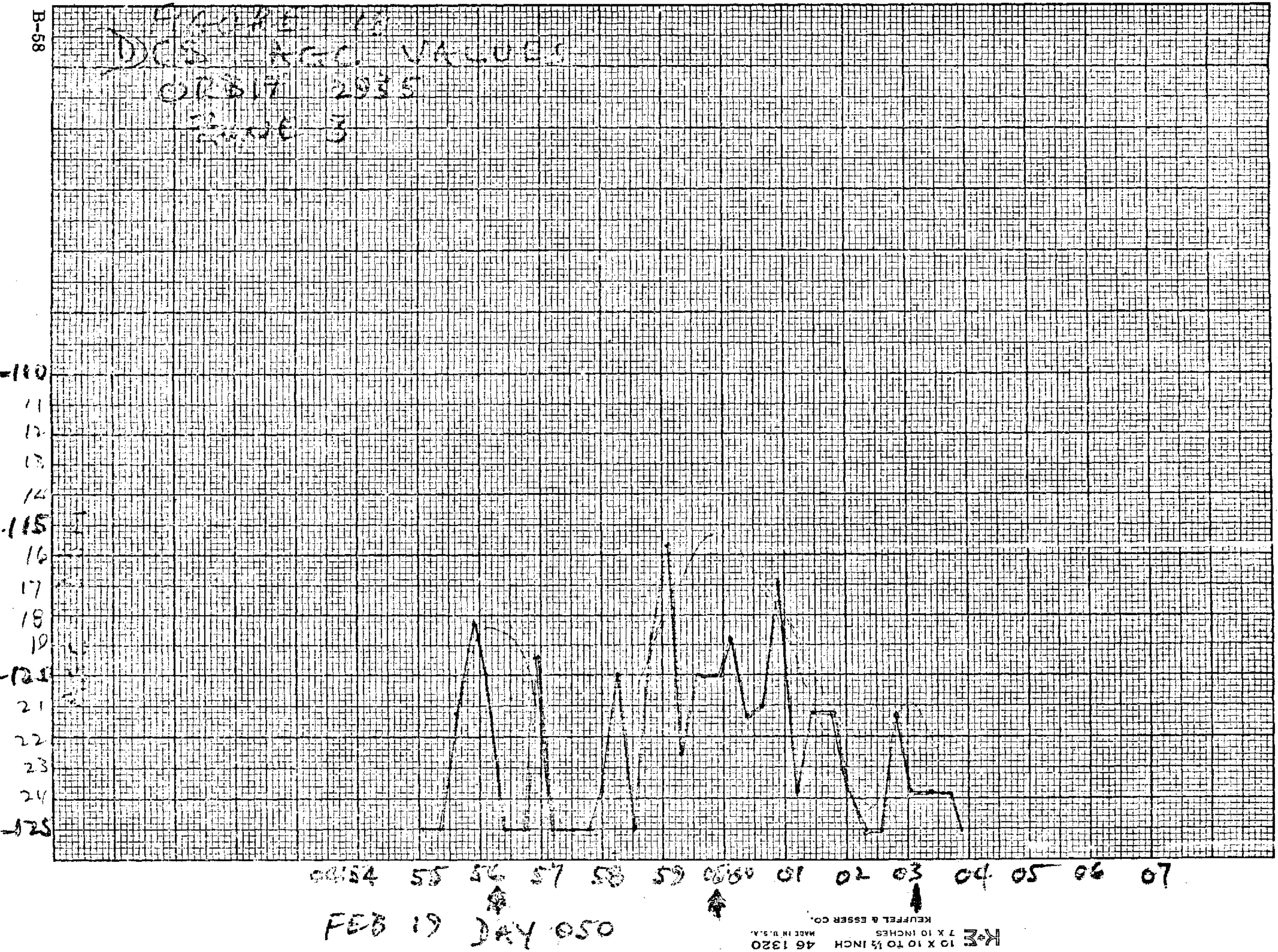


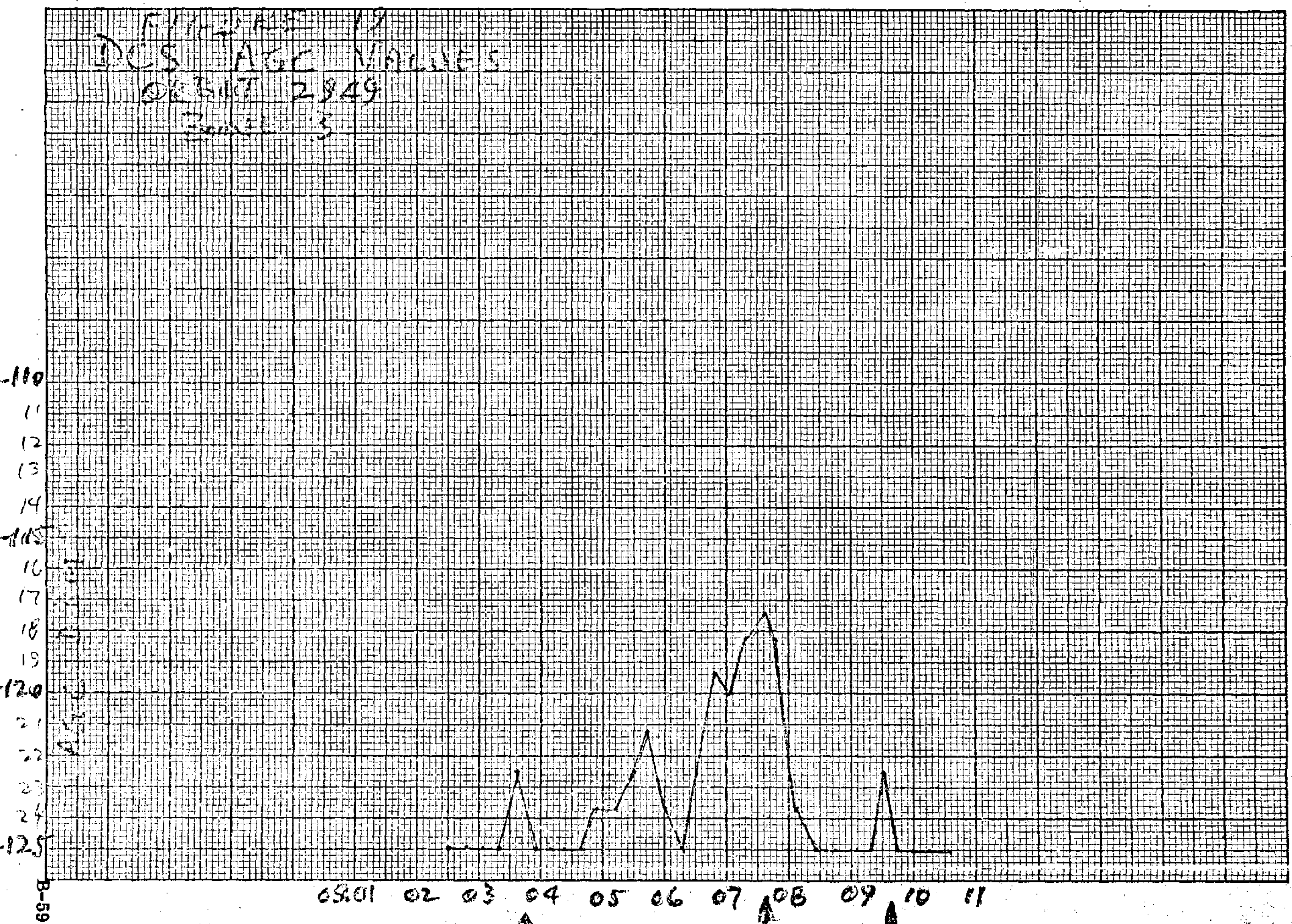
FEB 23 DAY 054-03:


DCS AGC VALUES
-105
-110
-115
-120
-125
37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
FEB 24



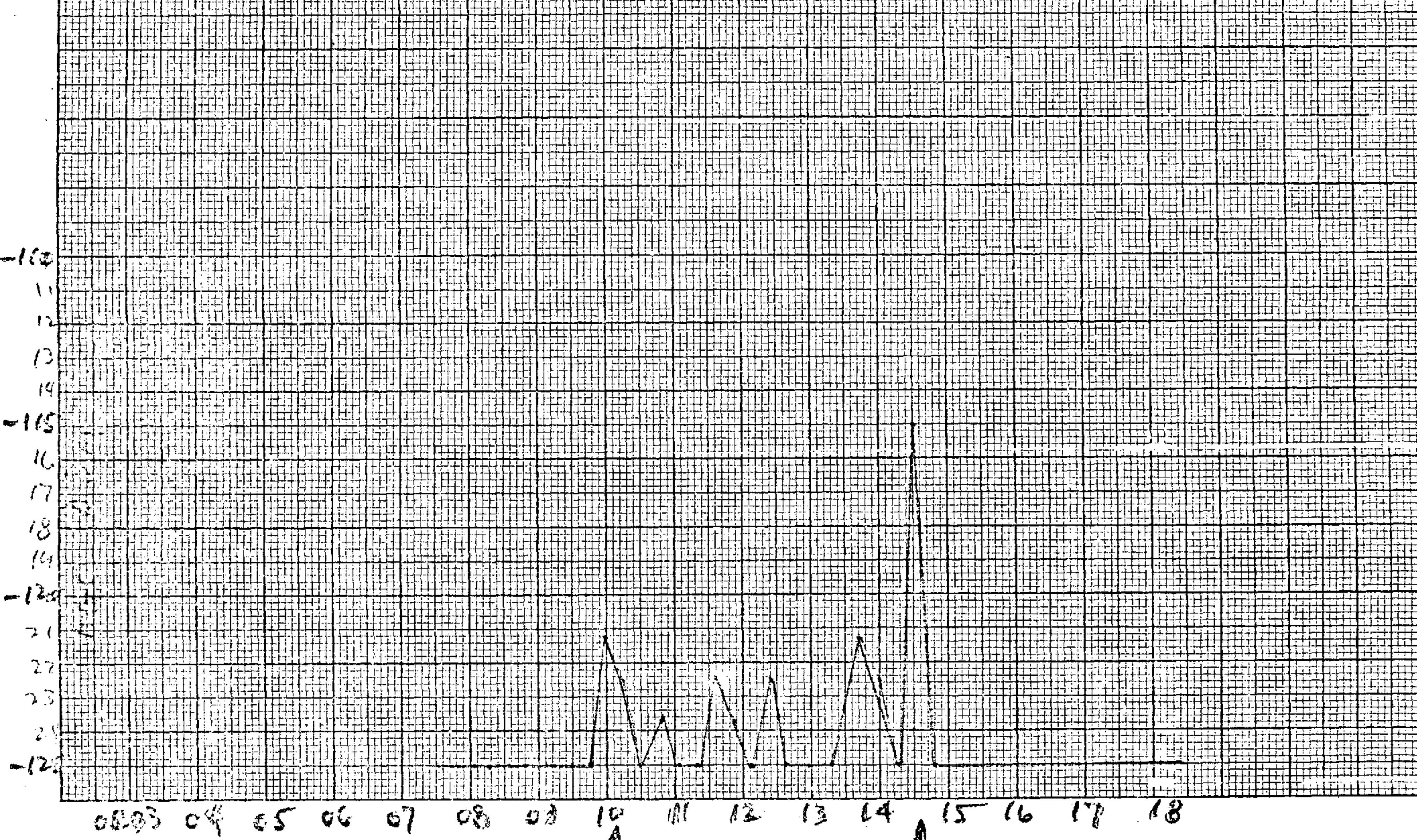
DAY 049
FEB 18-04:


DCS AGC VALUES
ORBIT 2935
PAGE 3
-110
11
12
13
14
-115
16
17
18
19
-120
21
22
23
24
-125
00154 55 56 57 58 59 00160 01 02 03 04 05 06 07
FEB 19 DAY 050

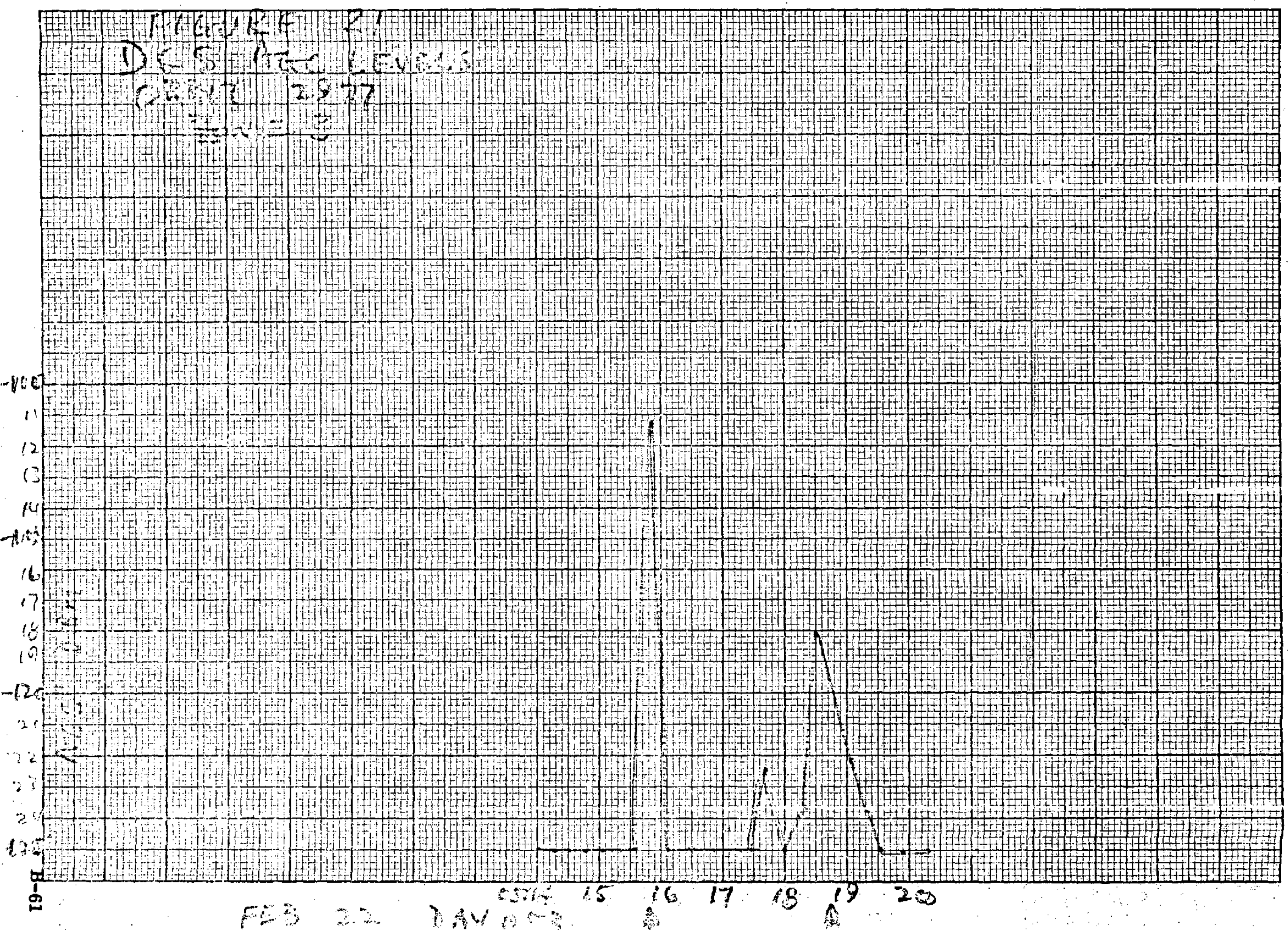


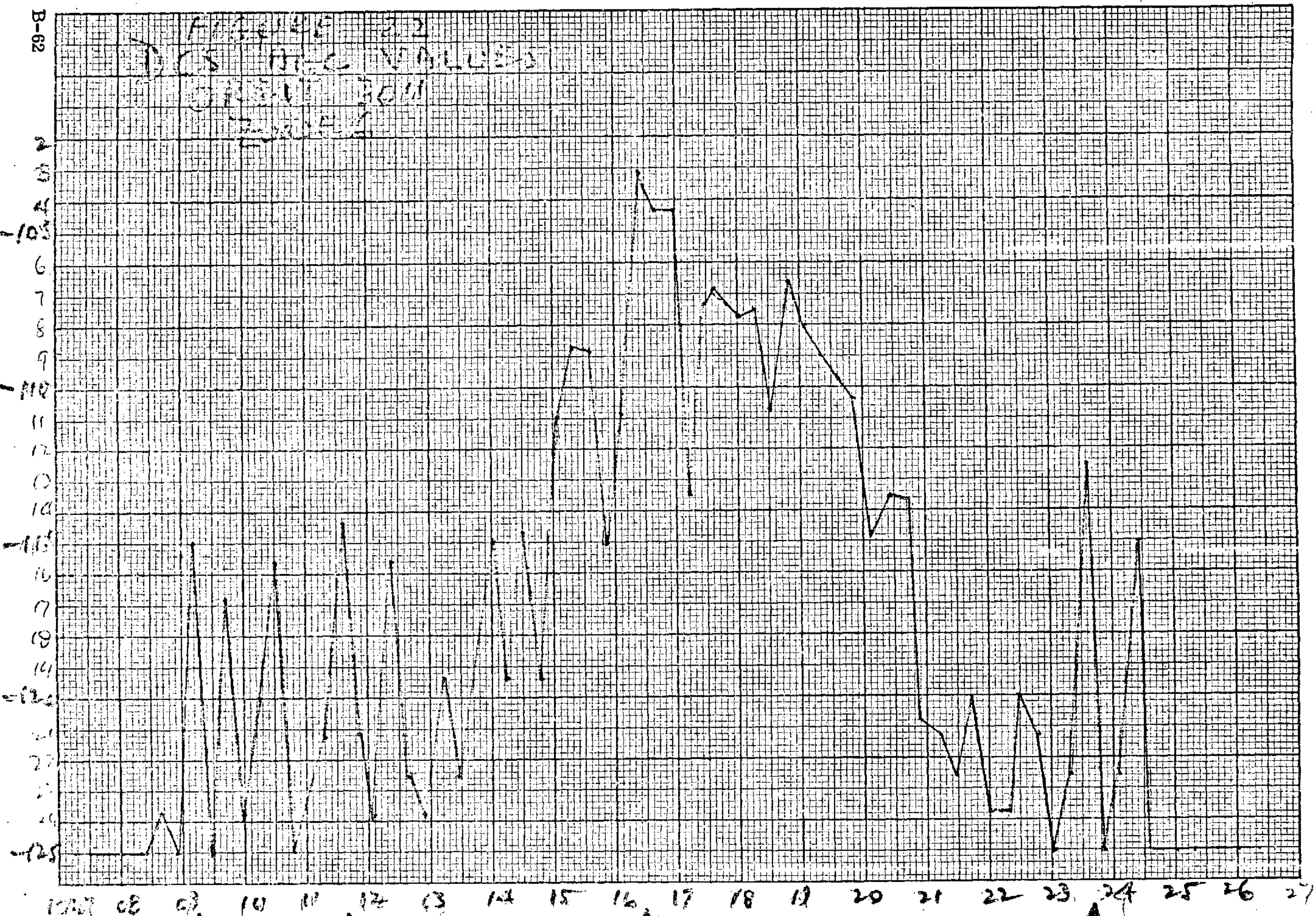
FEB 20 DAY 051

FIGURE 76
DCS AGC LEVELS
ORBIT 2063
ZONE 3

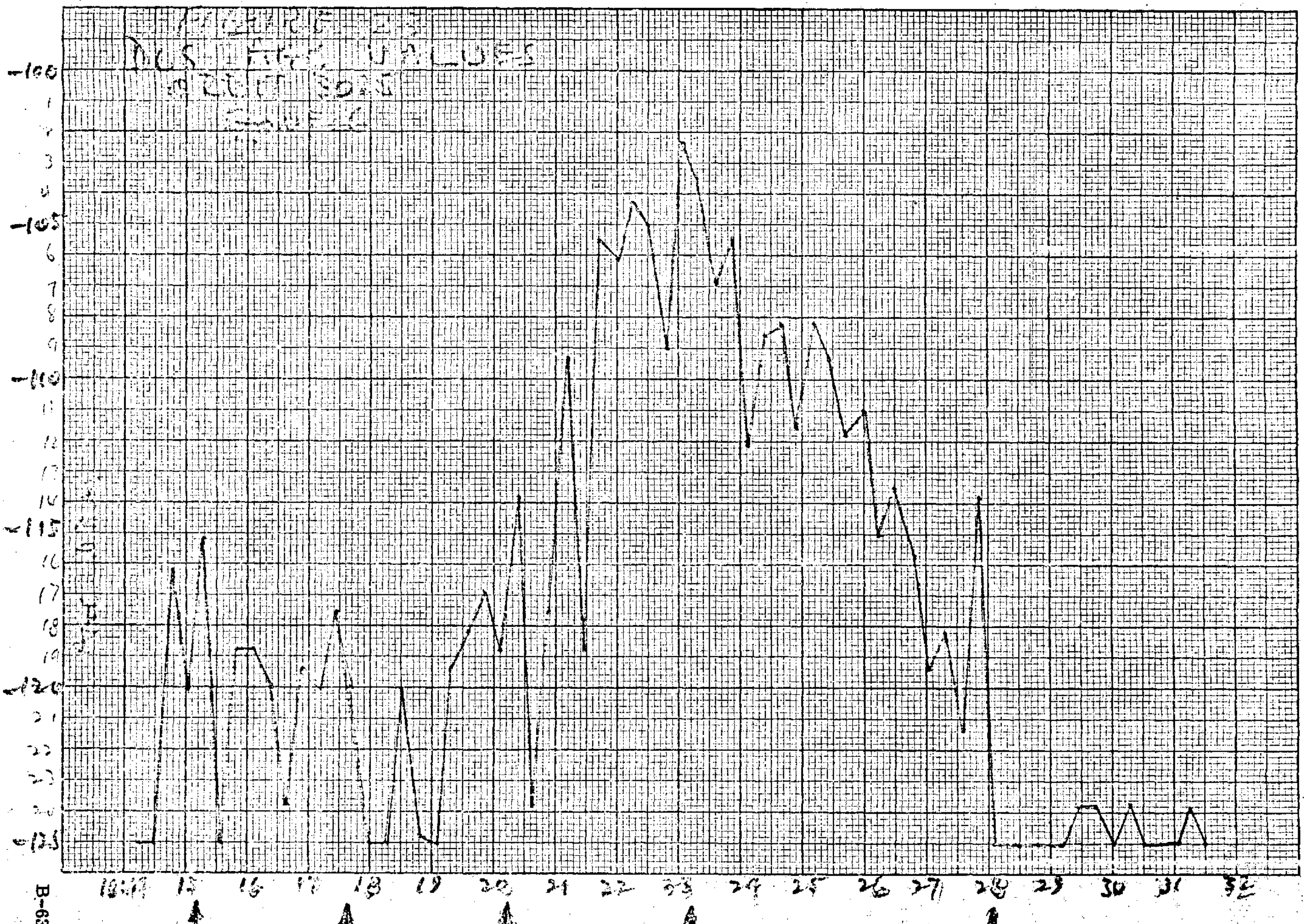


FEB 21 DAY 052


2877
15
16
17
18
19
20
FEB

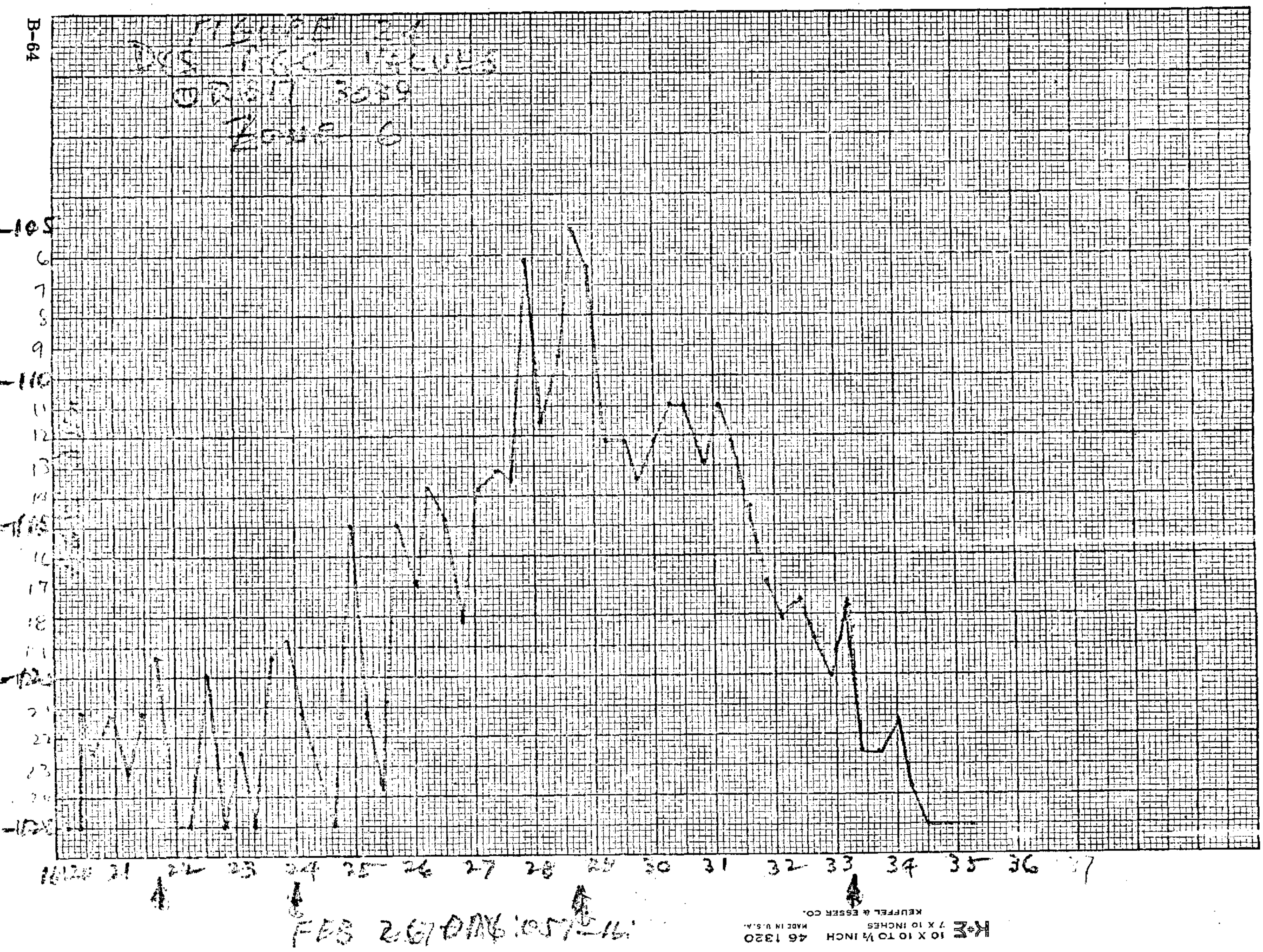


FEB 24 DAY 055-16:



B-63

FEB 25 DAY 056+16!



-105
-110
-120
-125
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

Figures 25 through 30 are plots of AGC values for the Zone 7 orbits. This family of orbits experienced peak AGC levels of -110.3, -111, -113.8, -114.5 (neglecting two extreme points), -114.7 and -111.6 dbm respectively. The gradual decline in AGC readings indicates recession from the interfering source and the leveling off and finally rising of the AGC level is consistant with entering a lobe of the interfering source with a suitable angle of elevation.

From the analyses above, it becomes clear that the major source of interference lies between Zones 2 and 3 and between Zones 6 and 7. It was obviously desirable to examine additional members of one of these families of orbits until they passed over the interfering source. Because the orbit families step westward daily, only those in Zones 2 and 6 could be considered. Those in Zone 2 were selected for further examination because these orbits are more nearly perpendicular to the line to the suspect interfering source and therefore are more revealing.

Additional orbits from the family of Zone 2 would step westward into Zone 3, and hence are labelled Zones 2/3. Figures 31 through 34 are plots of AGC values for four more of this family of orbits. Maximum AGC levels were-106.2, -107.3, -111.4 and -110.3 respectively. The first two of these orbits each had AGC levels rise intermittantly above -110 dbm for about 1.6 minutes total. On February 27, the AGC level recorded a double-hump cycle, with the mid-low point occuring at 04:01:45, corresponding to a spacecraft position of 34° N 101°W, suspected of being in the near-overhead null of the interfering source. Neither the preceding nor the following orbits in this family exhibited this double-hump in the AGC pattern.

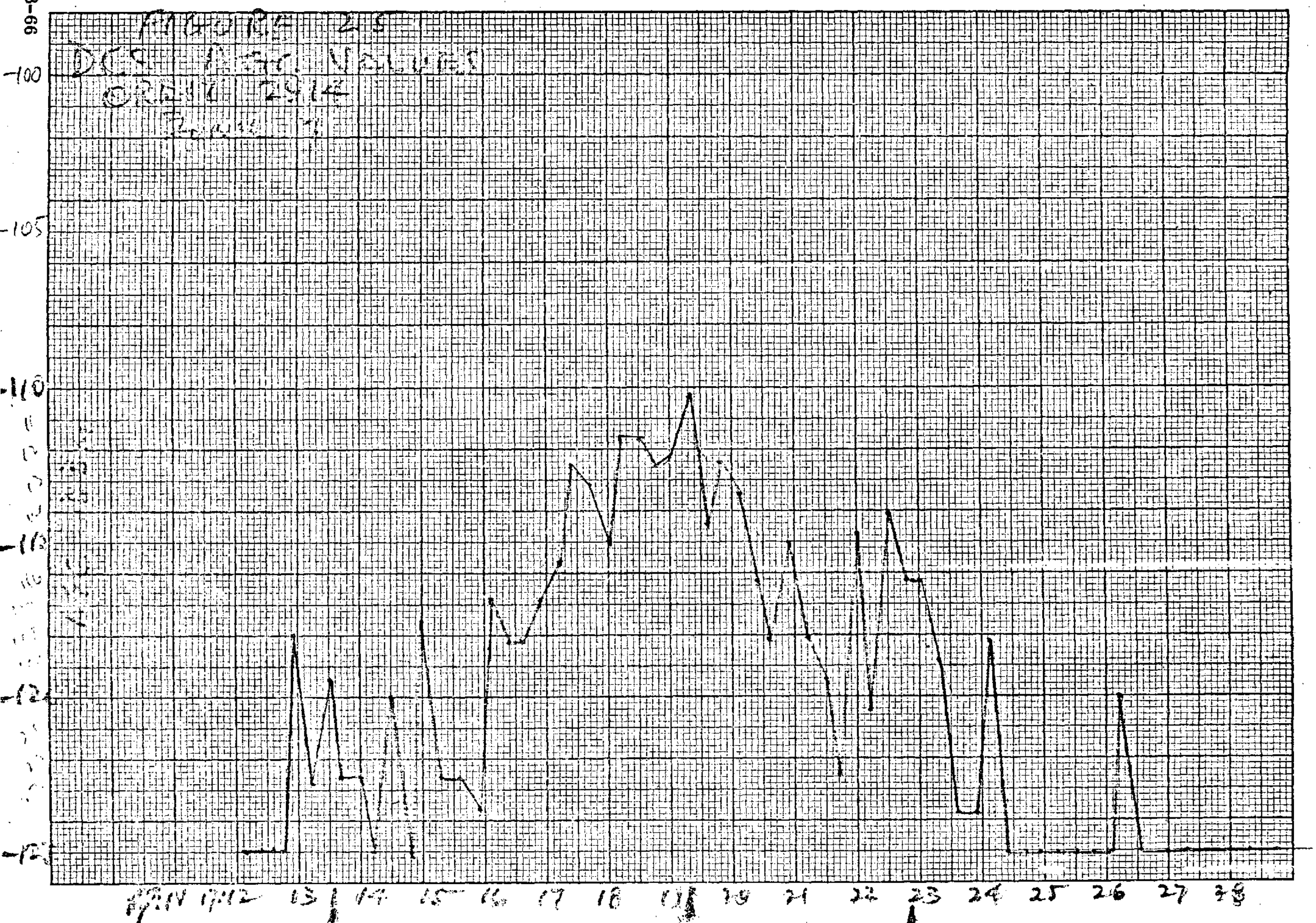
Data from Figures 12 through 34 were used to plot the geographic location of AGC peaks in Figure 35. The Zone 2 orbits (2906, 2920, 2948, 2990 and 3004) show very interesting characteristics. The points of maximum AGC level are roughly in a line NE to SW. The region of AGC level above -110 dbm define a triangle with apex pointing toward 32° N 100° W. Furthermore, orbit 2920 had a wider zone of this high level AGC values than did orbit 2906 farther east implying it was more nearly in the radiation lobe. This permitted calculation the elevation angle of the interfering lobe at about 30°.

The remaining orbits of this family (3018, 3032, 3046 and 3060) were geographically in Zone 3. Again their maximums were in the same NE-SW line observed in the prior orbits of this family.

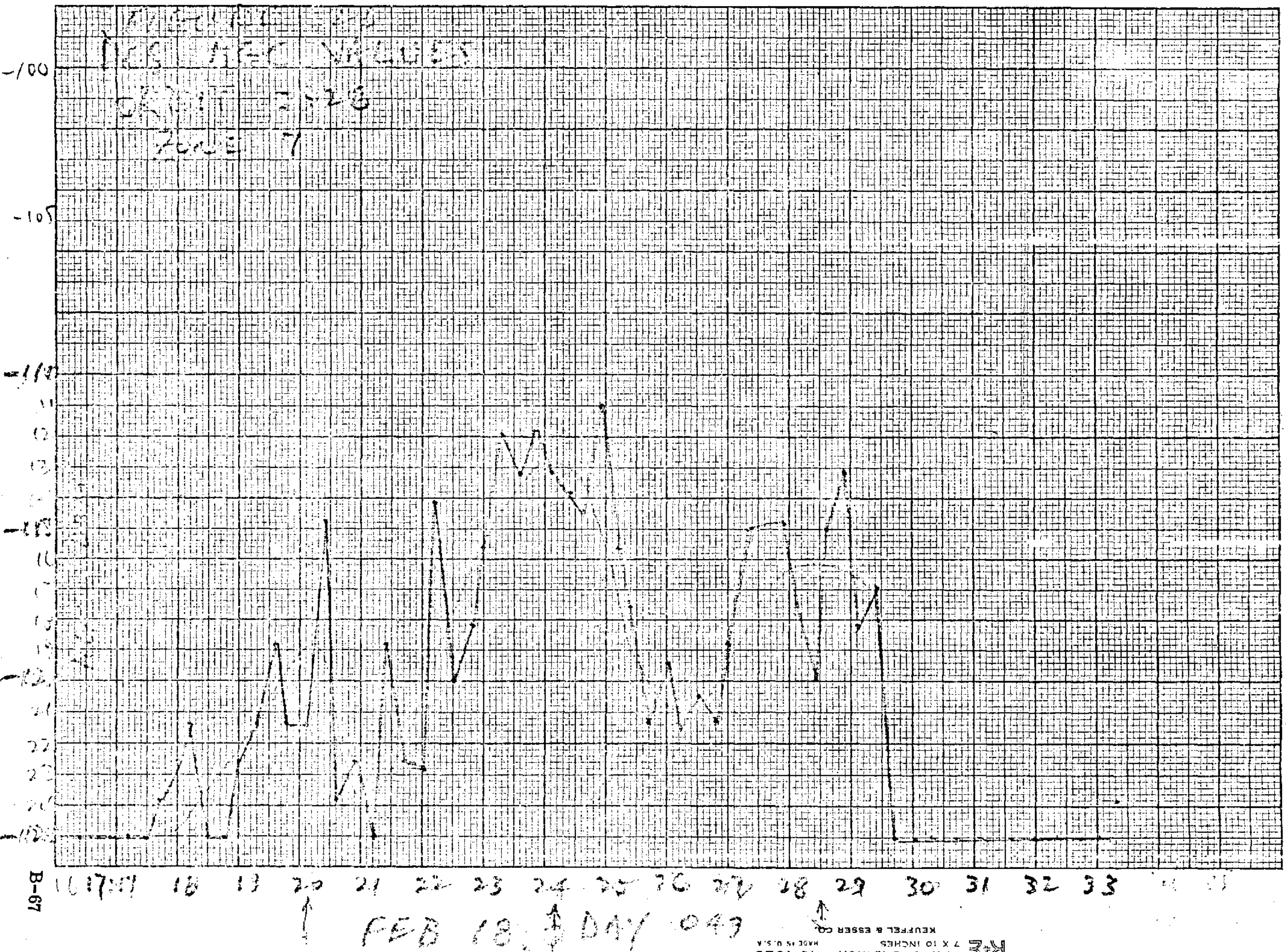
Other orbits in Zone 3 from the next orbit family occuring a few days previously (2921, 2935, 2949, 2963 and 2997) have relatively weak maximum AGC levels and are plotted as shown.

The Zone 6 orbits show many of the characteristics of the Zone 2 orbits. In only these two groups of orbits were there AGC levels above -110 dbm. The Zone 6 orbits (3011, 3025, and 3039) have their points of maximum AGC levels in a NE-SW direction but with a different slope and location than those of Zone 3. These two lines of maximum AGC levels intersect at about 33° N 100° W.

The Zone 7 orbits (2914, 2956, 2970, and 2984) make a convincing contribution to determination of the location of the interfering signal source. When the



FEB 17 DAY 48 - 17:


ARC VALUES
ZONE 7
-100
-105
-110
-115
-120
-125
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
FEB 18, DAY 049

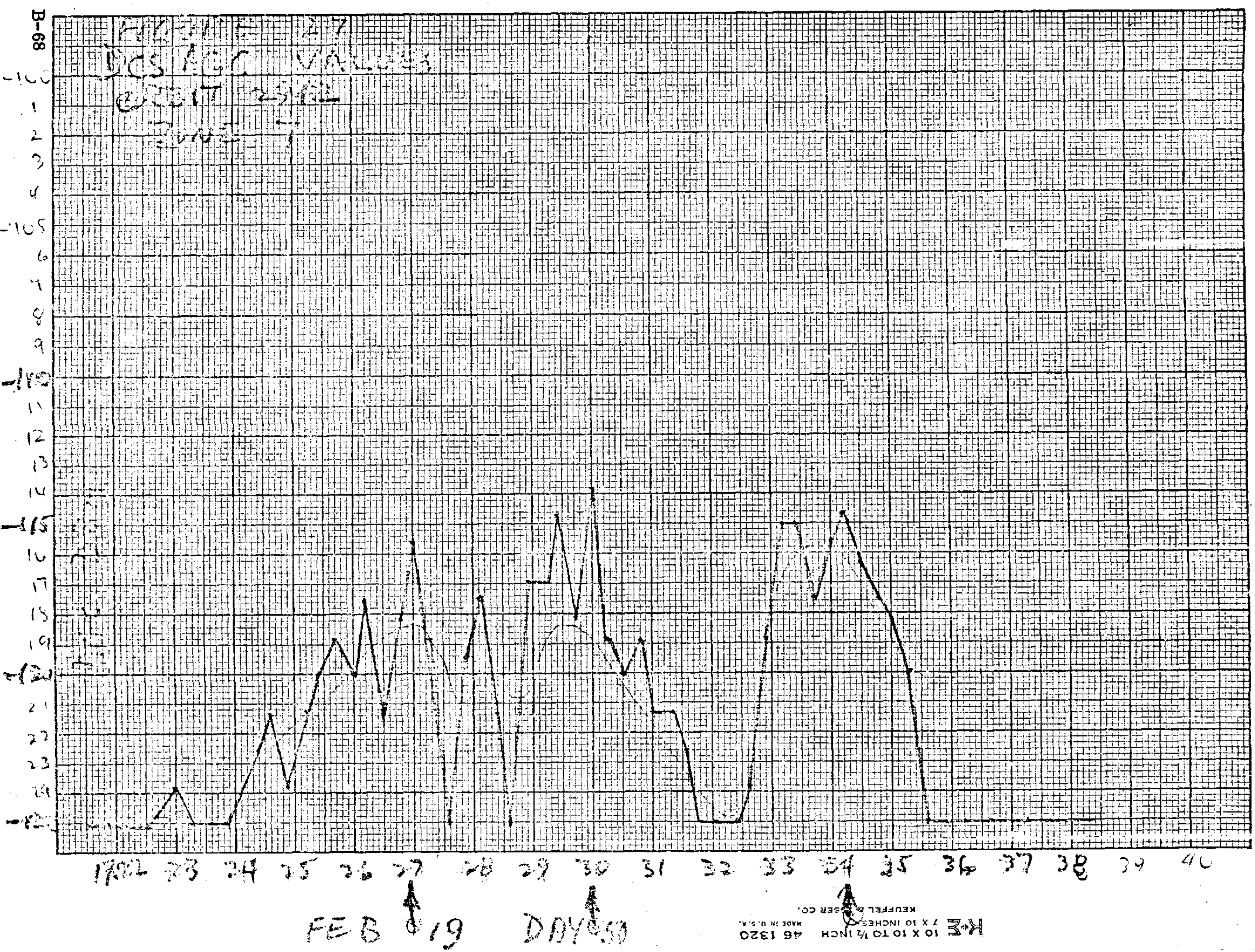
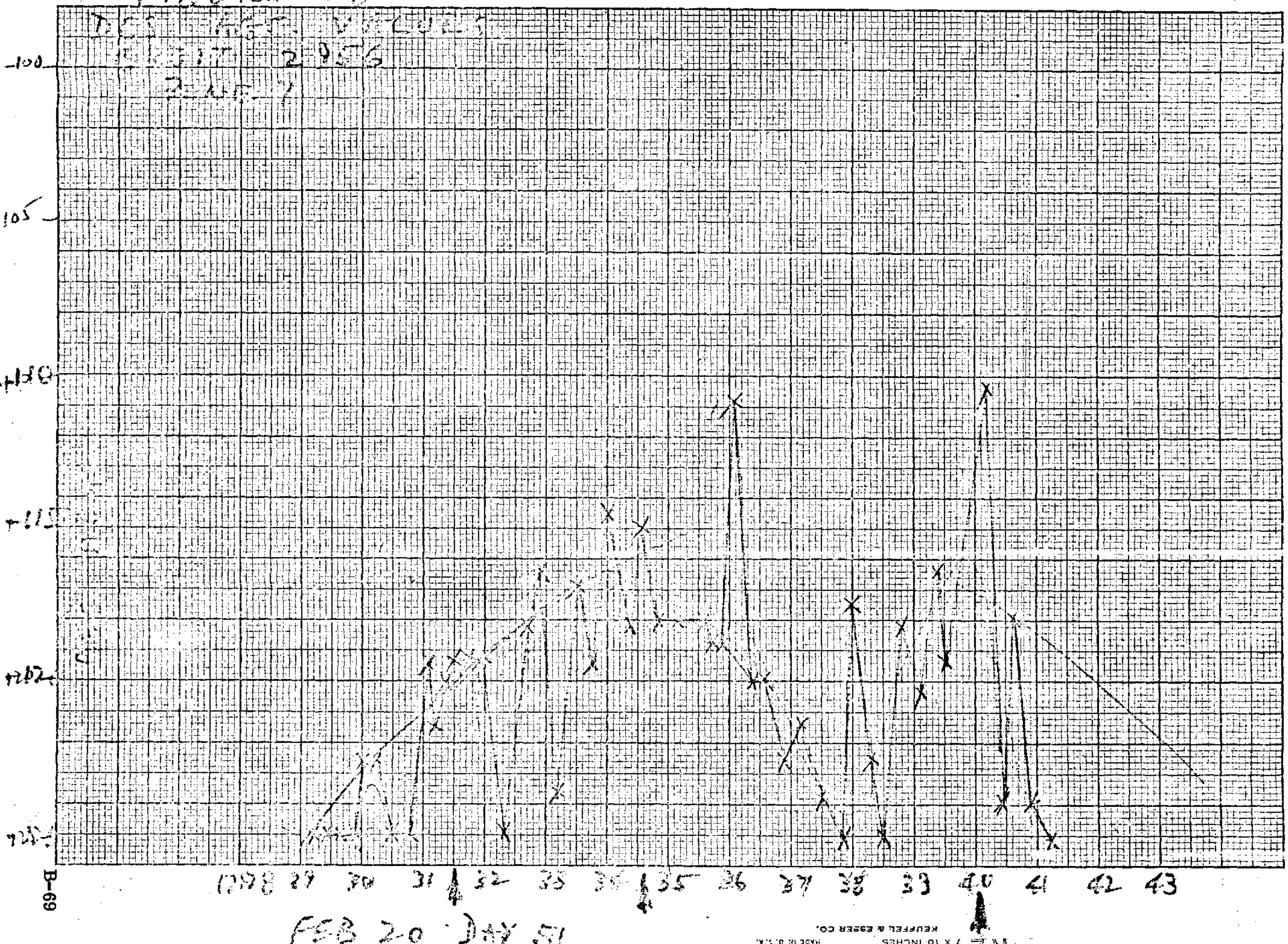

DCS AGC VALUES
-100
1
2
3
4
-105
6
7
8
9
-110
11
12
13
14
-115
16
17
18
19
-120
21
22
23
24
-125
1722
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
FEB 19
K+E 10 X 10 TO 1/2 INCH 46 1320
7 X 10 INCHES MADE IN U.S.A.
KEUFFEL & ESSER CO.

FIGURE 28



-100
105
+115
1298
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
FEB 20 DAY 51

B-70

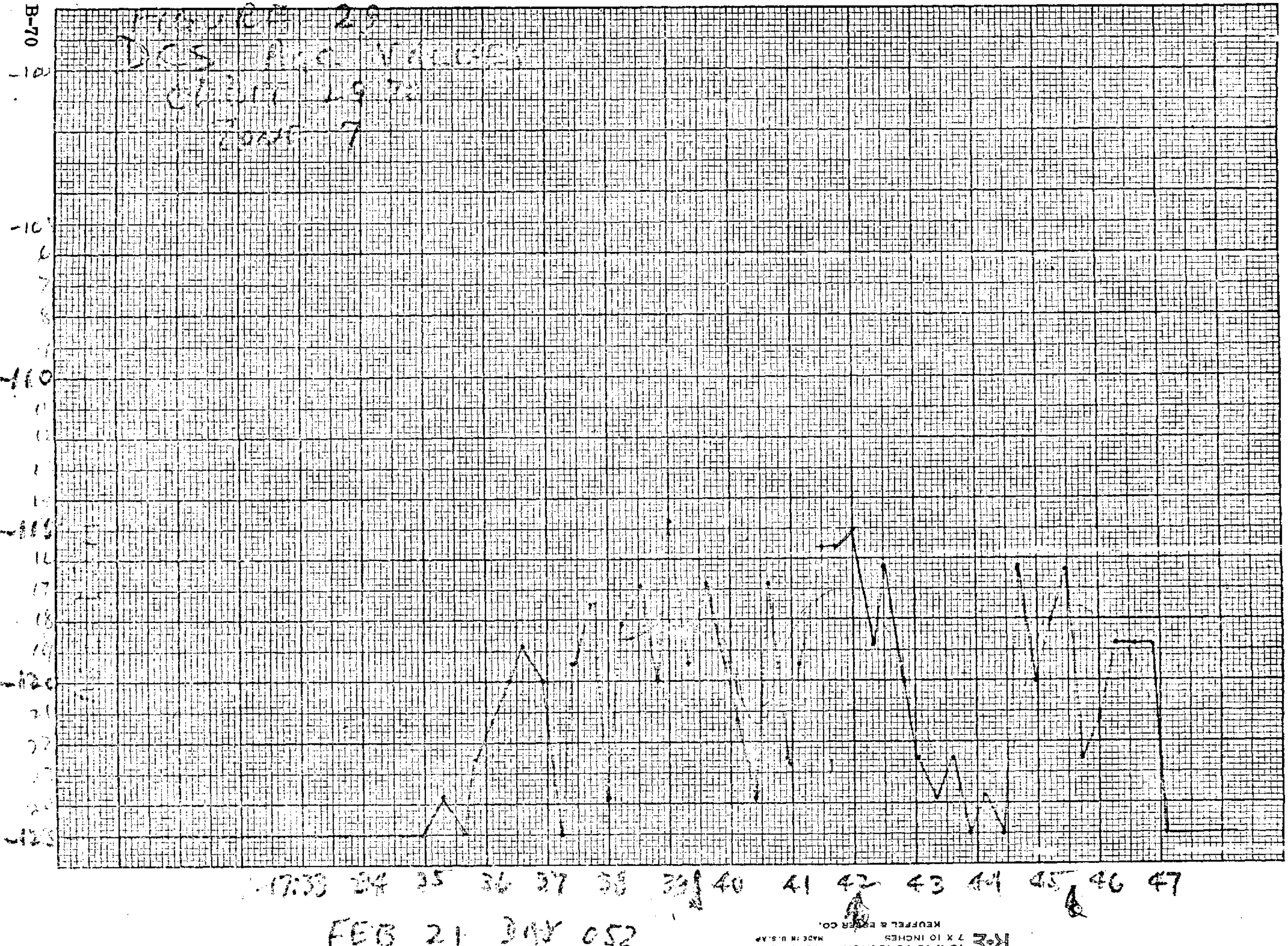
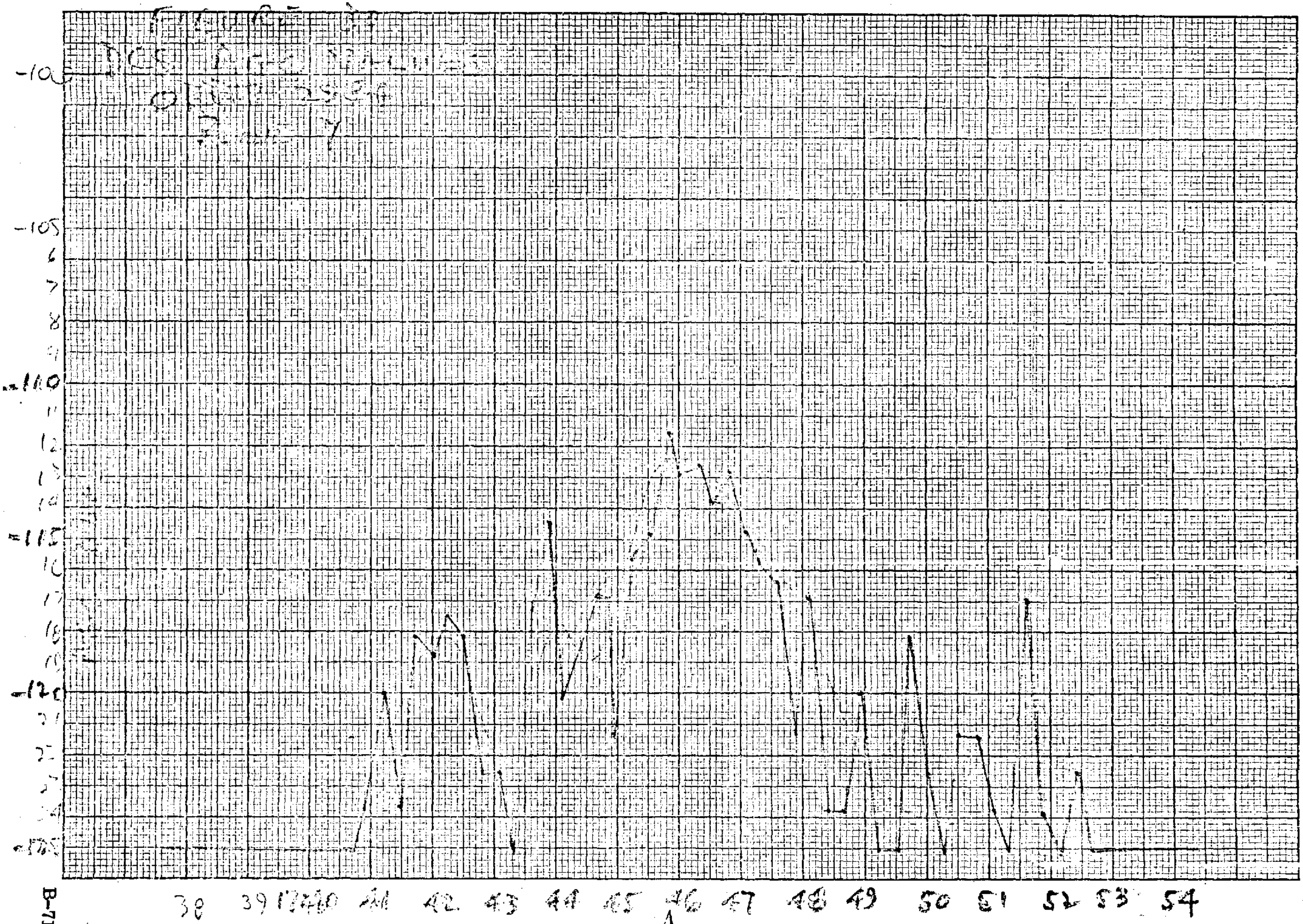
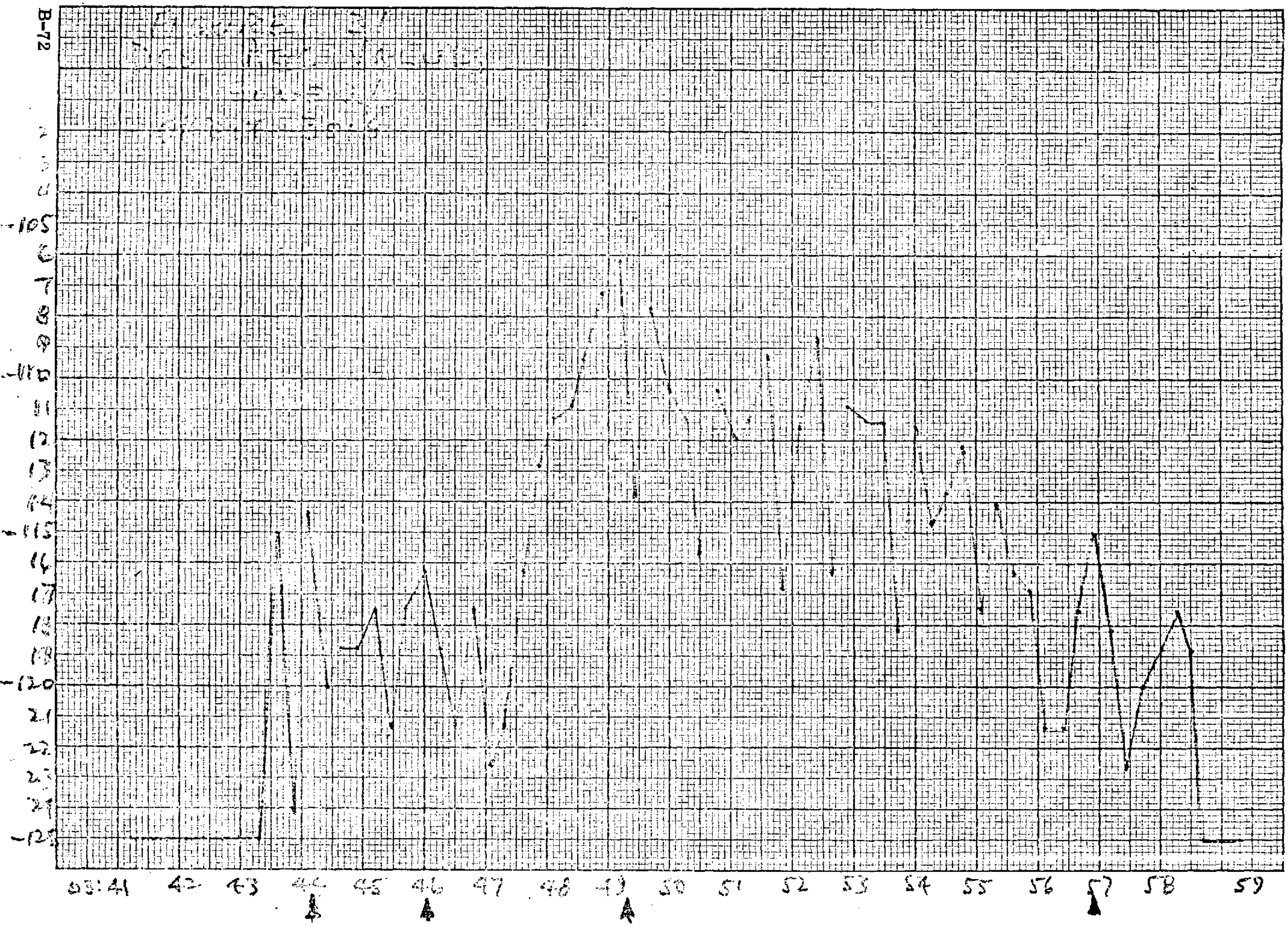


FIGURE 29
-110
-120
17:33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
FEB 21 DAY 052



FEB 22 DAY 053



DAY 056 FEB 25

FEB 26 DAY 057

FEB 27 DAY 058

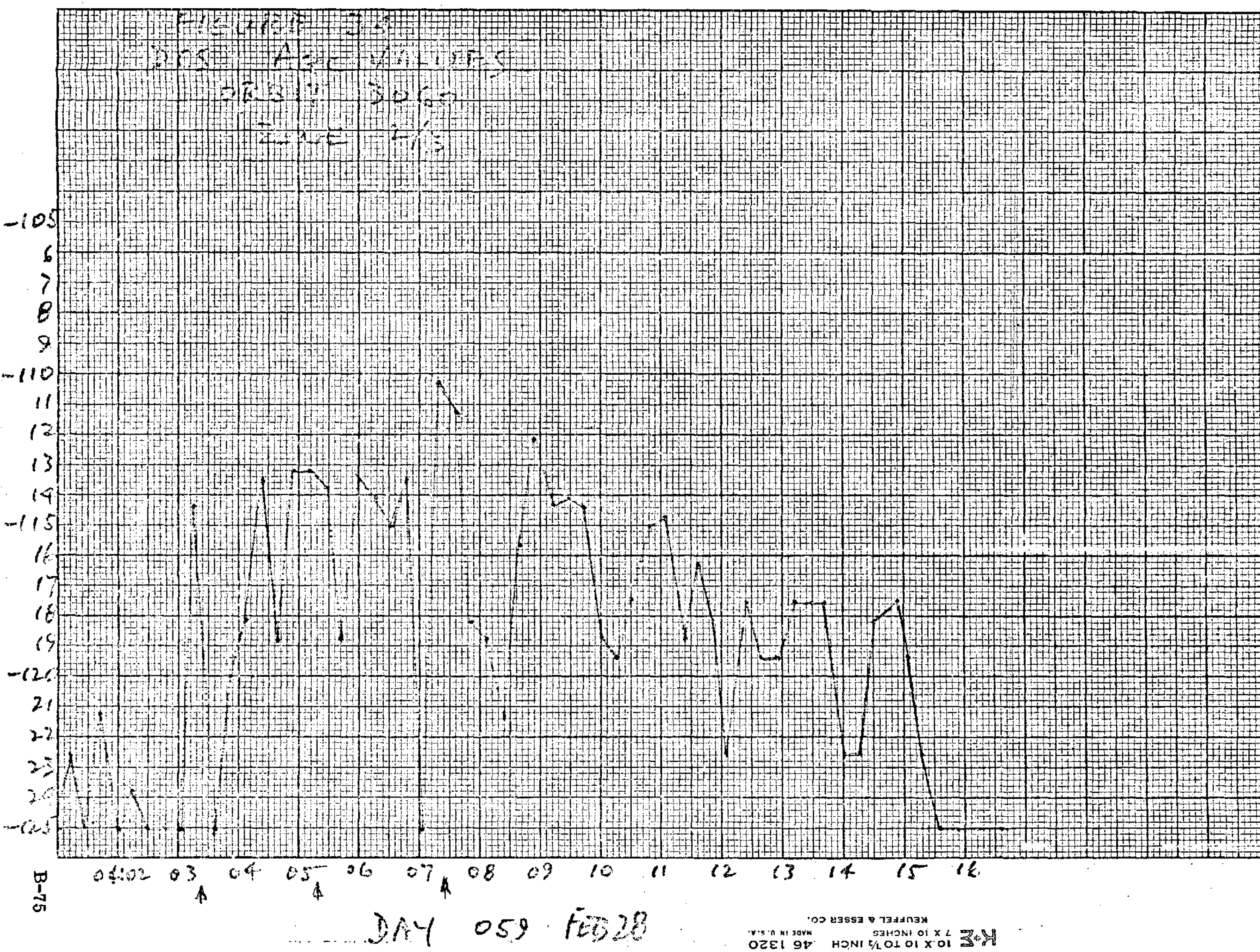
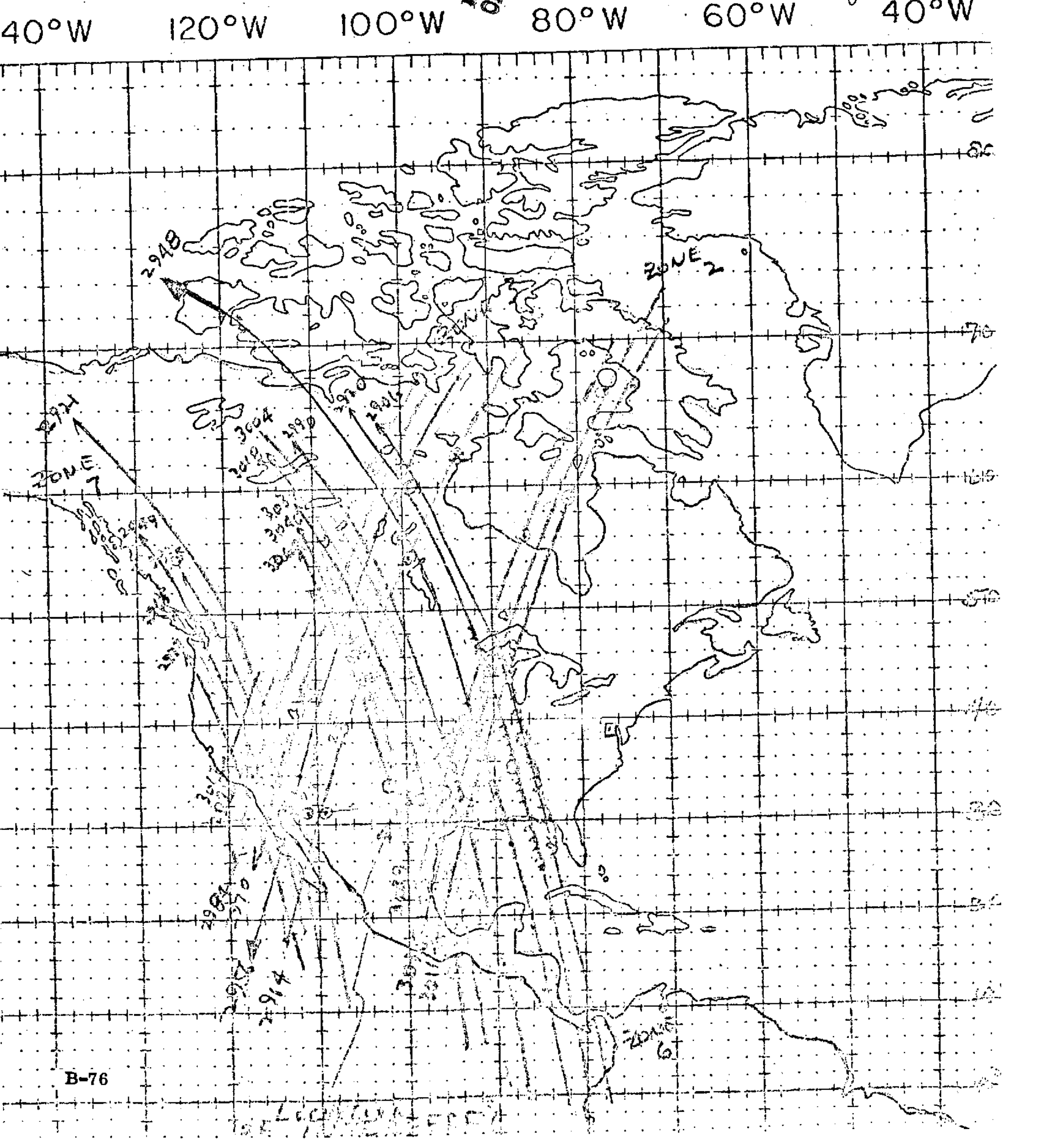


FIGURE 35
DTS AGC VALUES
-105
6
7
8
9
-110
11
12
13
14
-115
16
17
18
19
-120
21
22
23
04:02
03
04
05
06
07
08
09
10
11
12
13
14
15
16
DAY 059 FEB 28

FIGURE 35
GEOGRAPHIC LOCATION OF
AGC PEAKS

location of interferer

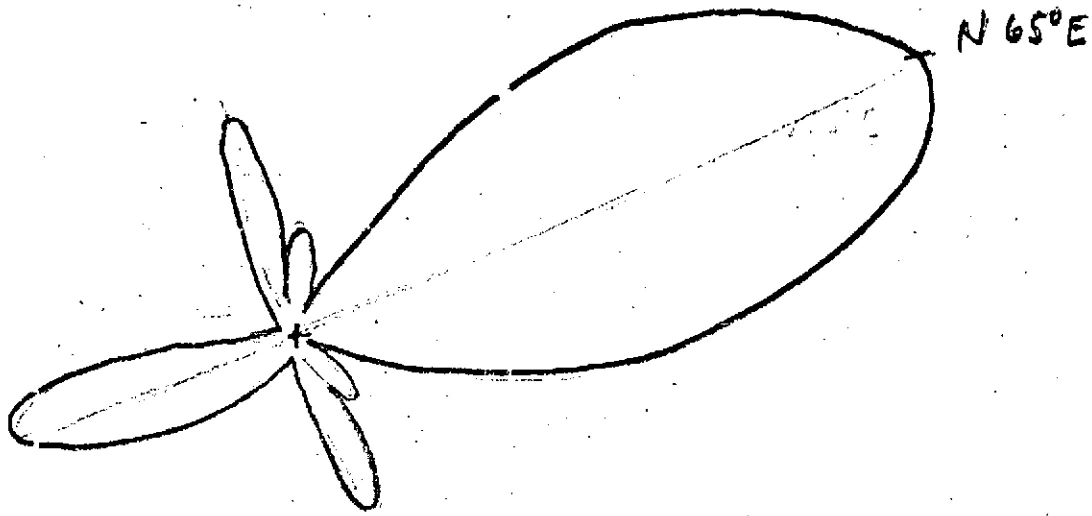


three locations per orbit of maximum AGC levels are plotted, they align themselves neatly into three converging lines that intersect in a small (50 miles maximum side) triangle at 33°N 101°W.

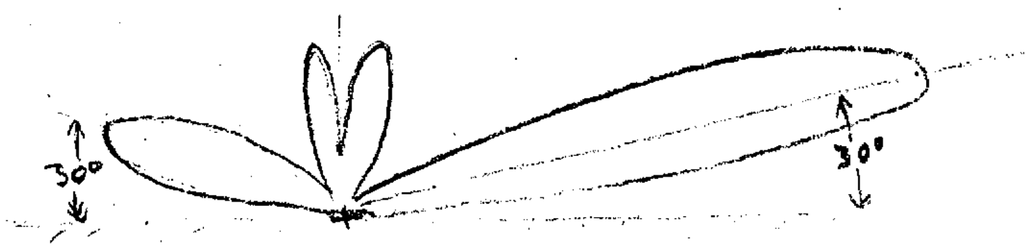
Thus four independent methods of location of the interfering source yield almost identical results. It is concluded with high confidence that the major source of interference experienced is located at 33°N 101°W ±100 miles.

Data is available to derive the antenna pattern, field contour lines, and probable power output of the interfering source. In addition, video tapes of the signal are available for examination to derive transmission characteristics of the signal. However, these studies are not treated here, because they are beyond the scope of this investigation, which was simply to determine the geographic location of the interfering signals. From Figure 35, however, it was possible to construct in Figure 36 a brief outline of the radiation pattern of the interfering signal.

In addition to this major source of interference, there is at least another source of interference--from the Nimbus to IRLS transmissions in the 401 mHz band. On February 20, in orbit 2957, Nimbus was near and above ERTS at 19:17:00. Nimbus transmitted to the ground-based IRLS from 19:16:00 to 19:18:00. At the same time, the ERTS DCS system was registering 30 bad messages between 19:16:20 and 19:17:53. Even while these bad messages were being recorded in the DCS system, 5 good messages were also being received, about normal for that time span and geographic location, showing the system was not disabled during this interference, but simply recording as messages--flagged bad--the signals being received from Nimbus. Without these 30 "bad" messages the percent of bad messages for that orbit would have dropped from the 51% shown in Table 1 to 4.5%.



HORIZONTAL PATTERN



VERTICAL PATTERN

FIGURE 36

RADIATION PATTERN OF INTERFERING SOURCE

APPENDIX C

ERTS-1 DCS PLATFORM LISTS

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : Distribution DATE: 5 April 1973

FROM : J. Williamson - 430

SUBJECT: DCS Platform Lists

Reference: Memos from ERTS DCS Engineer (Painter) to USER SERVICES (Holmes), "Platform Activations", 21 and 25 March 1973.

The attached lists give the latest DCS platform locations, users, data products, etc.

The following updates are now being entered into the NDPF Sigma 5 (Reference).

(1) Preble (I015) - gave up four of twenty-five platforms
(2) Lum (N130) - new user added with one platform
(3) Friedman (I023) - three platforms added for a total of five

The total number of platforms remains 218 (including 4 assigned to OCC/VF). The number of users is increased to 30 (including OCC and VF).

Corrections or additions should be given to Ron Gale (X2719).

James M. Williamson
James M. Williamson
Assistant Operations Director
ERTS Project

Distribution

L. Gonzales	E. Painter
L. Smith	J. Boeckel
R. Holmes	E. Szajna
W. Webb	E. Crump
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RUN

JMW
GSFC-430
4-02-73

ERTS DCS PLATFORMS
SORTED BY USER ID

USER ID	PRO REQ	PLATFORM OCT	PLATFORM DEC	LAT	LONG	LOC	STUDY	VALID	USER	AFFILIATION
D002	RLH	6010	8	41-45N	71-27W	RI	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6012	10				HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6021	17	44-52N	69-51W	MAIN	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6042	34				HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6071	57	45-14N	68-39W	MAIN	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6101	65	41-02N	73-32W	CONN	HYDR	7-23-72	COOPER	ARMY ENG-MASS
D002	RLH	6106	70	43-46N	70-47W	NH	HYDR	11-07-72	COOPER	ARMY-ENG-MASS
D002	RLH	6127	87	41-46N	72-40W	CONN	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6142	98	42-34N	71-47W	MASS	HYDR	11-07-72	COOPER	ARMY ENG-MASS
D002	RLH	6147	103	42-24N	71-13W	MASS	HYDR	7-23-72	COOPER	ARMY ENG MASS
D002	RLH	6170	120	45-14N	68-39W	MAIN	HYDR	11-07-72	COOPER	ARMY ENG MASS
D002	RLH	6171	121				HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6201	129				HYDR	11-07-72	COOPER	ARMY ENG-MASS
D002	RLH	6206	134	43-45W	71-41W	NH	HYDR	11-07-72	COOPER	ARMY-ENG-MASS
D002	RLH	6207	135	42-24N	71-13W	MASS	HYDR	7-23-72	COOPER	ARMY ENG-MASS
D002	RLH	6216	142	43-43N	72-17W	NH	HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6220	144	42-15N	71-00W	MASS	HYDR	7-23-72	COOPER	ARMY ENG-MASS
002	RLH	6233	155				HYDR	11-07-72	COOPER	ARMY ENG-MASS
D002	RLH	6242	162	42-09N	72-35W	MASS	HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6246	166	42-15N	71-00W	MASS	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6254	172	42-47N	72-23W	NH	HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6271	185	47-15N	68-35W	MAIN	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6272	186				HYDR	11-07-72	COOPER	ARMY ENG MASS
D002	RLH	6273	187				HYDR	11-07-72	COOPER	ARMY ENG-MASS
D002	RLH	6304	196	44-04N	70-12W	MAIN	HYDR	11-27-72	COOPER	ARMY-ENG-MASS
D002	RLH	6325	213	43-43N	72-17W	NH	HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6335	221				HYDR	11-07-72	COOPER	ARMY ENG-MASS
D002	RLH	6345	229	42-59N	71-35W	NH	HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6355	237	42-06N	72-38W	NY	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6356	238	42-15N	71-15W	MASS	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D011	LH	6074	60				HYDR	10-24-72	KEE	USN OCEANGRAPH
D011	LH	6153	107				HYDR	10-24-72	KEE	USN OCEANGRAPH
D011	LH	6336	222				HYDR	10-24-72	KEE	USN OCEANGRAPH
I015	LH	6004	4			MISS	HYDR	8-31-72	PREBLE	USGS-MISS
I015	LH	6013	11			MISS	HYDR	12-15-72	PREBLE	USGS-MISS
I015	LH	6017	15			MISS	HYDR	8-31-72	PREBLE	USGS-MISS
I015	LH	6024	20			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6051	41			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6107	71			MISS	HYDR	8-31-72	PREBLE	USGS-MISS
I015	LH	6110	72			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6122	82			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6136	94			MISS	HYDR	8-31-72	PREBLE	USGS-MISS
I015	LH	6157	111			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6204	132			MISS	HYDR	11-27-72	PREBLE	USGS-MISS

1015	LH	6230	152			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
1015	LH	6245	165			MISS	HYDR	8-31-72	PREBLE	USGS-MISS
1015	LH	6257	175			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
1015	LH	6263	179			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
015	LH	6266	182			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
1015	LH	6301	193			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
1015	LH	6303	195			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
1015	LH	6327	215			MISS	HYDR	8-31-72	PREBLE	USGS-MISS
1015	LH	6337	223			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
1015	LH	6351	233			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
1023	LH	6020	16	40-30N	121-15W	CALF	GEOL	8-31-72	FRIEDMAN	USGS-WASH-DC
1023	LH	6056	46				GEOL	9-22-72	FRIEDMAN	USGS-WASH-DC
1023	LH	6104	68	40-30N	121-20W	CALF	GEOL	8-31-72	FRIEDMAN	USGS-WASH-DC
1023	LH	6156	118				GEOL	9-22-72	FRIEDMAN	USGS-WASH-DC
1023	LH	6251	169				GEOL	8-31-72	FRIEDMAN	USGS-WASH-DC
N024	RLH	6014	12				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6022	18				HYDR	8-31-72	KRIEGER	NASA-WALLOPS
N024	RLH	6023	19				HYDR	11-08-72	KRIEGER	NASA-WALLOPS
N024	RLH	6032	26				HYDR	8-31-72	KRIEGER	NASA-WALLOPS
N024	RLH	6035	29				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6050	40				HYDR	11-08-72	KRIEGER	NASA-WALLOPS
N024	RLH	6052	42				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6072	58				HYDR	8-31-72	KRIEGER	NASA-WALLOPS
N024	RLH	6133	91				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6226	150				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6305	197				HYDR	8-31-72	KRIEGER	NASA-WALLOPS
N024	RLH	6324	212				HYDR	11-08-72	KRIEGER	NASA-WALLOPS
N024	RLH	6333	219				HYDR	11-08-72	KRIEGER	NASA-WALLOPS
N024	RLH	6350	232				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6360	240				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6375	253				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6401	257				HYDR	7-23-72	KRIEGER	NASA-WALLOPS
1025	RL	6025	21			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6040	32			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6062	50			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6143	99			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6202	13			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6212	138			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6241	161			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6347	231			COLO	MET	11-27-72	KAHAN	RECLAMATION
1066	LH	6006	6	33-44N	112-37W	ARIZ	HYDR	8-31-72	SCHUMAN	USGS-PHOENIX
1066	LH	6016	14				HYDR	7-23-72	SCHUMAN	USGS-PHOENIX
1066	LH	6151	105				HYDR	8-31-72	SCHUMAN	USGS-PHOENIX
1066	LH	6165	117				HYDR	9-22-72	SCHUMAN	USGS-PHOENIX
1066	LH	6177	127				HYDR	8-31-72	SCHUMAN	USGS-PHOENIX
1066	LH	6225	149	33-29N	109-46W	ARIZ	HYDR	9-22-72	SCHUMAN	USGS-PHOENIX
1066	LH	6251	177	34-38N	111-51W	ARIZ	HYDR	8-31-72	SCHUMAN	USGS-PHOENIX
100D	LH	6007	7				HMET	9-22-72	HOFFER	COLORADO UNIV
100D	LH	6054	44				HMET	9-22-72	HOFFER	COLORADO UNIV
02D	L	6155	109			OHIO		10-24-72	SWEET	BATTELLE LABS
103D	LH	6047	39			ARIZ		10-24-72	HENDRICKSON	ARIZ UNIV

103D	LH	6167	119			ARIZ		10-24-72	HENDRICKSON	ARIZ UNIV
103D	LH	6361	241			ARIZ		10-24-72	HENDRICKSON	ARIZ UNIV
104D	LH	6140	96	44-16N	103-47W	SDAK	AGFR	7-23-72	HELLER	USDA-CALIF
04D	LH	6175	125	44-16N	103-47W	SDAK	AGFR	7-23-72	HELLER	USDA-CALIF
104D	LH	6317	207	44-16N	103-47W	SDAK	AGFR	7-23-72	HELLER	USDA-CALIF
105D	L	6060	48				HYDR	10-24-72	HENRY	ALA UNIV
105D	L	6061	49				HYDR	10-24-72	HENRY	ALA UNIV
105D	L	6105	69				HYDR	10-24-72	HENRY	ALA UNIV
105D	L	6120	80				HYDR	10-24-72	HENRY	ALA UNIV
105D	L	6156	110				HYDR	10-24-72	HENRY	ALA UNIV
105D	L	6164	116				HYDR	10-24-72	HENRY	ALA UNIV
105D	L	6224	148				HYDR	10-24-72	HENRY	ALA UNIV
105D	L	6265	181				HYDR	10-24-72	HENRY	ALA UNIV
105D	L	6323	211				HYDR	10-24-72	HENRY	ALA UNIV
105D	L	6346	230				HYDR	10-24-72	HENRY	ALA UNIV
105D	L	6357	239				HYDR	10-24-72	HENRY	ALA UNIV
106D		7701	961	38-59N	76-51W	GSFC	TEST	7-23-72	SMITH	NASA-GSFC
106D	LB	7707	967	38-59N	76-51W	GSFC	TEST	7-23-72	SMITH	NASA-GSFC
N130	LB	6075	61			CALF		11-27-72	LUM	NASA-AMES
1340	RLH	6030	24	41-02N	75-01W	PENN	HYDR	7-23-72	PAULSON	USGS-HARISBG
1340	RLH	6046	38	39-33N	75-51W	NJ	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6057	55	39-41N	75-41W	DEL	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6073	59	40-58N	76-52W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6114	76	39-30N	75-34W	DEL	HYDR	8-31-72	PAULSON	USGS-HARISBG
340	RLH	6115	77	39-58N	75-11W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
340	RLH	6116	78	41-18N	74-47W	NJ	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6124	64	39-34N	75-34W	DEL	HYDR	7-23-72	PAULSON	USGS-HARISBG
1340	RLH	6215	141	39-42N	75-27W	NJ	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6223	147	41-00N	75-05W	NJ	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6227	151	40-36N	75-22W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6275	189	40-04N	74-51W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6277	191	40-13N	74-46W	NJ	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6306	198	40-41N	75-12W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6307	199	40-15N	76-52W	PENN	HYDR	12-15-72	PAULSON	USGS-HARISBG
1340	RLH	6312	202	40-42N	75-11W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6322	210	39-33N	75-27W	NJ	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6331	217	40-01N	74-59W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6332	218	39-50N	75-22W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6341	225	39-58N	75-11W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6343	227	40-13N	74-46W	NJ	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6344	228	39-57N	75-08W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6367	247	39-57N	75-08W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6371	249	39-57N	75-08W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6373	251	41-45N	76-26W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6402	258	40-28N	77-07W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
N347	L	6044	36				HYDR	8-31-72	ERB	NASA-MSC
N347	L	6045	37				HYDR	8-31-72	ERB	NASA-MSC
N347	L	6077	63				HYDR	7-23-72	ERB	NASA-MSC
N347	L	6112	74				HYDR	8-31-72	ERB	NASA-MSC
347	L	6125	85				HYDR	7-23-72	ERB	NASA-MSC
N347	L	6152	106				HYDR	8-31-72	ERB	NASA-MSC
N347	L	6211	137				HYDR	8-31-72	ERB	NASA-MSC

N347	L	6234	156				HYDR	8-31-72	ERB	NASA-MSC
N347	L	6235	157				HYDR	8-31-72	ERB	NASA-MSC
N347	L	6244	164				HYDR	8-31-72	ERB	NASA-MSC
F360	RLB	6102	66	51-38N	86-24W	ONT	HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6126	86	50-38N	117-03W	BC	HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6137	95				HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6150	104	59-23N	108-53W	SASK	HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6232	154				HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6260	176	61-52N	121-21W	NWT	HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6353	235				HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6354	236	51-01N	118-05W	BC	HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6366	246				HMET	8-31-72	CAMPBELL	-ONTARIO
F368	RL	6270	184	46-52N	71-39W	QUEB	HMET	8-31-72	PERRIER	RESOURCES-QUE
I378	L	6144	100				HYDR	11-08-72	CAMERON	USGS-LOUISANA
I378	L	6237	159				HYDR	11-08-72	CAMERON	USGS-LOUISANA
I380	L	6063	51	42-40N	70-54W	MASS		11-27-72	KNOX	USGS-BOSTON
I381	L	6037	31				HYDR	10-24-72	BARNES	USGS-NASHVILE
I381	L	6203	131				HYDR	10-24-72	BARNES	USGS-NASHVILE
I382	L	6264	180	45-23N	122-07W	OREG	HYDR	10-24-72	KAPUTSKA	USGS-OREGON
I384	LH	6005	5				GEOL	8-31-72	EATON	USGS-CALIF
I384	LH	6011	9				GEOL	9-22-72	EATON	USGS-CALIF
I384	LH	6034	28				GEOL	9-22-72	EATON	USGS-CALIF
384	LH	6036	30				GEOL	10-24-72	EATON	USGS-CALIF
I384	LH	6043	35				GEOL	8-31-72	EATON	USGS-CALIF
I384	LH	6057	47				GEOL	8-31-72	EATON	USGS-CALIF
I384	LH	6066	54				GEOL	7-23-72	EATON	USGS-CALIF
I384	LH	6103	67				GEOL	8-31-72	EATON	USGS-CALIF
I384	LH	6117	79				GEOL	10-24-72	EATON	USGS-CALIF
I384	LH	6132	90				GEOL	10-24-72	EATON	USGS-CALIF
I384	LH	6154	108				GEOL	9-22-72	EATON	USGS-CALIF
I384	LH	6162	114				GEOL	7-23-72	EATON	USGS-CALIF
I384	LH	6163	115				GEOL	9-22-72	EATON	USGS-CALIF
I384	LH	6176	126				GEOL	8-31-72	EATON	USGS-CALIF
I384	LH	6213	139				GEOL	8-31-72	EATON	USGS-CALIF
I384	LH	6240	160				GEOL	10-24-72	EATON	USGS-CALIF
I384	LH	6247	167				GEOL	9-22-72	EATON	USGS-CALIF
I384	LH	6262	178				GEOL	9-22-72	EATON	USGS-CALIF
I384	LH	6274	188				GEOL	10-24-72	EATON	USGS-CALIF
I384	LH	6276	190				GEOL	9-22-72	EATON	USGS-CALIF
I384	LH	6311	201				GEOL	10-24-72	EATON	USGS-CALIF
I384	LH	6315	205				GEOL	8-31-72	EATON	USGS-CALIF
I384	LH	6320	208				GEOL	8-31-72	EATON	USGS-CALIF
I384	LH	6334	220				GEOL	9-22-72	EATON	USGS-CALIF
I384	LH	6342	226				GEOL	8-31-72	EATON	USGS-CALIF
I384	LH	6365	245				GEOL	8-31-72	EATON	USGS-CALIF
I384	LH	6370	248				GEOL	8-31-72	EATON	USGS-CALIF
I384	LH	6372	250				GEOL	10-24-72	EATON	USGS-CALIF
I414	RLH	6031	25			FLA	HYDR	7-23-72	HIGER	USGS-MIAMI
I414	RLH	6033	27			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
I414	RLH	6055	45			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI

1414	RLH	6070	56			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6121	81			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
1414	RLH	6141	97			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6214	140			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
1414	RLH	6236	158			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6250	168			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6252	170			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
1414	RLH	6256	174			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6313	203			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
1414	RLH	6321	209			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6352	242			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
1414	RLH	6363	243			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
F461	RLO	6210	136				HMET	8-31-72	KRUUS	FISH-OTTAWA
F501	RL	6222	146				HMET	8-31-72	ZUBRYCKY	FISH-OTTAWA
F502	RLO	6135	93	43-17N	79-08W	ONT	HMET	8-31-72	MACPHAIL	IN WATER-ONT
F503	RL	6330	216				HMET	8-31-72	VOCKEROTH	ATMOS-ONT
P550	LO	7000	512	40-05N	75-23W	PENN	TEST	7-23-72	WOOD	GE-VF
P550		7001	513	40-05N	75-23W	PENN	TEST	7-23-72	WOOD	GE-VF
U661	LH	6131	89			KANS		10-24-72	KANEMASU	KSU-KANSAS
U661	LH	6310	200			KANS		10-24-72	KANEMASU	KSU-KANSAS

STOP 0

RUN

ERTS DCS PLATFORMS
SORTED BY USER AFFILIATION

****
* FEDERAL *
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USER ID	PROD REQ	PLATFORM OCT	PLATFORM DEC	LAT	LONG	LOC	STUDY	VALID	USER	AFFILIATION
104D	LH	6140	96	44-16N	103-47W	SDAK	AGFR	7-23-72	HELLER	USDA-CALIF
104D	LH	6175	125	44-16N	103-47W	SDAK	AGFR	7-23-72	HELLER	USDA-CALIF
104D	LH	6317	207	44-16N	103-47W	SDAK	AGFR	7-23-72	HELLER	USDA-CALIF
D002	RLH	6010	8	41-45N	71-27W	RI	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6012	10				HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6021	17	44-52N	69-51W	MAIN	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6042	34				HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6071	57	45-14N	68-39W	MAIN	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6101	65	41-02N	73-32W	CONN	HYDR	7-23-72	COOPER	ARMY ENG-MASS
D002	RLH	6106	70	43-48N	70-47W	NH	HYDR	11-07-72	COOPER	ARMY-ENG-MASS
D002	RLH	6127	87	41-46N	72-40W	CONN	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6142	98	42-34N	71-47W	MASS	HYDR	11-07-72	COOPER	ARMY ENG-MASS
D002	RLH	6147	103	42-24N	71-13W	MASS	HYDR	7-23-72	COOPER	ARMY ENG MASS
D002	RLH	6170	120	45-14N	68-39W	MAIN	HYDR	11-07-72	COOPER	ARMY ENG MASS
D002	RLH	6171	121				HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6201	129				HYDR	11-07-72	COOPER	ARMY ENG-MASS
D002	RLH	6206	134	43-45W	71-41W	NH	HYDR	11-07-72	COOPER	ARMY-ENG-MASS
D002	RLH	6207	135	42-24N	71-13W	MASS	HYDR	7-23-72	COOPER	ARMY ENG-MASS
D002	RLH	6216	142	43-43N	72-17W	NH	HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6220	144	42-15N	71-00W	MASS	HYDR	7-23-72	COOPER	ARMY ENG-MASS
D002	RLH	6233	155				HYDR	11-07-72	COOPER	ARMY ENG-MASS
D002	RLH	6242	162	42-09N	72-35W	MASS	HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6246	166	42-15N	71-00W	MASS	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6254	172	42-47N	72-23W	NH	HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6271	185	47-15N	68-35W	MAIN	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6272	186				HYDR	11-07-72	COOPER	ARMY ENG MASS
D002	RLH	6273	187				HYDR	11-07-72	COOPER	ARMY ENG-MASS
D002	RLH	6304	196	44-04N	70-12W	MAIN	HYDR	11-27-72	COOPER	ARMY-ENG-MASS
D002	RLH	6325	213	43-43N	72-17W	NH	HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6335	221				HYDR	11-07-72	COOPER	ARMY ENG-MASS
D002	RLH	6345	229	42-59N	71-35W	NH	HYDR	11-27-72	COOPER	ARMY ENG MASS
D002	RLH	6355	237	42-06N	72-38W	NY	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D002	RLH	6356	238	42-15N	71-15W	MASS	HYDR	8-31-72	COOPER	ARMY ENG-MASS
D011	LH	6074	60				HYDR	10-24-72	KEE	USN OCEANGRAPH
D011	LH	6153	107				HYDR	10-24-72	KEE	USN OCEANGRAPH
D011	LH	6336	222				HYDR	10-24-72	KEE	USN OCEANGRAPH
N024	RLH	6014	12				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6022	18				HYDR	8-31-72	KRIEGER	NASA-WALLOPS

N024	RLH	6023	19			HYDR	11-08-72	KRIEGER	NASA-WALLOPS
N024	RLH	6032	26			HYDR	8-31-72	KRIEGER	NASA-WALLOPS
N024	RLH	6035	29			HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6050	40			HYDR	11-08-72	KRIEGER	NASA-WALLOPS
24	RLH	6052	42			HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6072	58			HYDR	8-31-72	KRIEGER	NASA-WALLOPS
N024	RLH	6133	91			HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6221	145			HYDR	7-23-72	KRIEGER	NASA-WALLOPS
N024	RLH	6226	150			HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6305	197			HYDR	8-31-72	KRIEGER	NASA-WALLOPS
N024	RLH	6324	212			HYDR	11-08-72	KRIEGER	NASA-WALLOPS
N024	RLH	6333	219			HYDR	11-08-72	KRIEGER	NASA-WALLOPS
N024	RLH	6350	232			HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6360	240			HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6375	253			HYDR	12-15-72	KRIEGER	NASA-WALLOPS
N024	RLH	6401	257			HYDR	7-23-72	KRIEGER	NASA-WALLOPS
N130	LB	6075	61		CALF		11-27-72	LUM	NASA-AMES
N347	L	6044	36			HYDR	8-31-72	ERB	NASA-MSC
N347	L	6045	37			HYDR	8-31-72	ERB	NASA-MSC
N347	L	6077	63			HYDR	7-23-72	ERB	NASA-MSC
N347	L	6112	74			HYDR	8-31-72	ERB	NASA-MSC
N347	L	6125	85			HYDR	7-23-72	ERB	NASA-MSC
N347	L	6152	106			HYDR	8-31-72	ERB	NASA-MSC
N347	L	6211	137			HYDR	8-31-72	ERB	NASA-MSC
N347	L	6234	156			HYDR	8-31-72	ERB	NASA-MSC
N347	L	6235	157			HYDR	8-31-72	ERB	NASA-MSC
N347	L	6244	164			HYDR	8-31-72	ERB	NASA-MSC
015	LH	6004	4		MISS	HYDR	8-31-72	PREBLE	USGS-MISS
I015	LH	6013	11		MISS	HYDR	12-15-72	PREBLE	USGS-MISS
I015	LH	6017	15		MISS	HYDR	8-31-72	PREBLE	USGS-MISS
I015	LH	6024	20		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6051	41		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6107	71		MISS	HYDR	8-31-72	PREBLE	USGS-MISS
I015	LH	6110	72		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6122	82		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6136	94		MISS	HYDR	8-31-72	PREBLE	USGS-MISS
I015	LH	6157	111		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6204	132		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6230	152		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6245	165		MISS	HYDR	8-31-72	PREBLE	USGS-MISS
I015	LH	6257	175		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6263	179		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6266	182		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6301	193		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6303	195		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6327	215		MISS	HYDR	8-31-72	PREBLE	USGS-MISS
I015	LH	6337	223		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I015	LH	6351	233		MISS	HYDR	11-27-72	PREBLE	USGS-MISS
I023	LH	6020	16	40-30N 121-15W	CALF	GEBL	8-31-72	FRIEDMAN	USGS-WASH-DC
I023	LH	6056	46			GEBL	9-22-72	FRIEDMAN	USGS-WASH-DC
I023	LH	6104	68	40-30N 121-20W	CALF	GEBL	8-31-72	FRIEDMAN	USGS-WASH-DC
23	LH	6156	118			GEBL	9-22-72	FRIEDMAN	USGS-WASH-DC
I023	LH	6251	169			GEBL	8-31-72	FRIEDMAN	USGS-WASH-DC

1025	RL	6025	21			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6040	32			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6062	50			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6143	99			COLO	MET	11-27-72	KAHAN	RECLAMATION
25	RL	6202	13			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6212	138			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6241	161			COLO	MET	11-27-72	KAHAN	RECLAMATION
1025	RL	6347	231			COLO	MET	11-27-72	KAHAN	RECLAMATION
1066	LH	6006	6	33-44N	112-37W	ARIZ	HYDR	8-31-72	SCHUMAN	USGS-PHOENIX
1066	LH	6016	14				HYDR	7-23-72	SCHUMAN	USGS-PHOENIX
1066	LH	6151	105				HYDR	8-31-72	SCHUMAN	USGS-PHOENIX
1066	LH	6165	117				HYDR	9-22-72	SCHUMAN	USGS-PHOENIX
1066	LH	6177	127				HYDR	8-31-72	SCHUMAN	USGS-PHOENIX
1066	LH	6225	149	33-29N	109-46W	ARIZ	HYDR	9-22-72	SCHUMAN	USGS-PHOENIX
1066	LH	6261	177	34-38N	111-51W	ARIZ	HYDR	8-31-72	SCHUMAN	USGS-PHOENIX
1340	RLH	6030	24	41-02N	75-01W	PENN	HYDR	7-23-72	PAULSON	USGS-HARISBG
1340	RLH	6046	38	39-33N	75-51W	NJ	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6067	55	39-41N	75-41W	DEL	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6073	59	40-58N	76-52W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6114	76	39-30N	75-34W	DEL	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6115	77	39-58N	75-11W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6116	78	41-18N	74-47W	NJ	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6124	84	39-34N	75-34W	DEL	HYDR	7-23-72	PAULSON	USGS-HARISBG
1340	RLH	6215	141	39-42N	75-27W	NJ	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6223	147	41-00N	75-05W	NJ	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6227	151	40-36N	75-22W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6275	189	40-04N	74-51W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6277	191	40-13N	74-46W	NJ	HYDR	10-24-72	PAULSON	USGS-HARISBG
40	RLH	6306	198	40-41N	75-12W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6307	199	40-15N	76-52W	PENN	HYDR	12-15-72	PAULSON	USGS-HARISBG
1340	RLH	6312	202	40-42N	75-11W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6322	210	39-33N	75-27W	NJ	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6331	217	40-01N	74-59W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6332	218	39-50N	75-22W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6341	225	39-58N	75-11W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6343	227	40-13N	74-46W	NJ	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6344	228	39-57N	75-08W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6367	247	39-57N	75-08W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6371	249	39-57N	75-08W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
1340	RLH	6373	251	41-45N	76-26W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
1340	RLH	6402	258	40-28N	77-07W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
1378	L	6144	100				HYDR	11-08-72	CAMERON	USGS-LOUISANA
1378	L	6237	159				HYDR	11-08-72	CAMERON	USGS-LOUISANA
1380	L	6063	51	42-40N	70-54W	MASS		11-27-72	KNOX	USGS-BOSTON
1381	L	6037	31				HYDR	10-24-72	BARNES	USGS-NASHVILE
1381	L	6203	131				HYDR	10-24-72	BARNES	USGS-NASHVILE
1382	L	6264	180	45-23N	122-07W	OREG	HYDR	10-24-72	KAPUTSKA	USGS-OREGON
1384	LH	6005	5				GEOL	8-31-72	EATON	USGS-CALIF
84	LH	6011	9				GEOL	9-22-72	EATON	USGS-CALIF
1384	LH	6034	28				GEOL	9-22-72	EATON	USGS-CALIF
1384	LH	6036	30				GEOL	10-24-72	EATON	USGS-CALIF

1384	LH	6043	35				GEOL	8-31-72	EATON	USGS-CALIF
1384	LH	6057	47				GEOL	8-31-72	EATON	USGS-CALIF
1384	LH	6066	54				GEOL	7-23-72	EATON	USGS-CALIF
1384	LH	6103	67				GEOL	8-31-72	EATON	USGS-CALIF
84	LH	6117	79				GEOL	10-24-72	EATON	USGS-CALIF
84	LH	6132	90				GEOL	10-24-72	EATON	USGS-CAL&F
1384	LH	6154	108				GEOL	9-22-72	EATON	USGS-CALIF
1384	LH	6162	114				GEOL	7-23-72	EATON	USGS-CALIF
1384	LH	6163	115				GEOL	9-22-72	EATON	USGS-CALIF
1384	LH	6176	126				GEOL	8-31-72	EATON	USGS-CALIF
1384	LH	6213	139				GEOL	8-31-72	EATON	USGS-CALIF
1384	LH	6247	167				GEOL	9-22-72	EATON	USGS-CALIF
1384	LH	6240	160				GEOL	10-24-72	EATON	USGS-CALIF
1384	LH	6262	178				GEOL	9-22-72	EATON	USGS-CALIF
1384	LH	6274	188				GEOL	10-24-72	EATON	USGS-CALIF
1384	LH	6276	190				GEOL	9-22-72	EATON	USGS-CALIF
1384	LH	6311	201				GEOL	10-24-72	EATON	USGS-CALIF
1384	LH	6315	205				GEOL	8-31-72	EATON	USGS-CALIF
1384	LH	6320	208				GEOL	8-31-72	EATON	USGS-CALIF
1384	LH	6334	220				GEOL	9-22-72	EATON	USGS-CALIF
1384	LH	6342	226				GEOL	8-31-72	EATON	USGS-CALIF
1384	LH	6365	245				GEOL	8-31-72	EATON	USGS-CALIF
1384	LH	6370	248				GEOL	8-31-72	EATON	USGS-CALIF
1384	LH	6372	250				GEOL	10-24-72	EATON	USGS-CALIF

1414	RLH	6031	25			FLA	HYDR	7-23-72	HIGER	USGS-MIAMI
1414	RLH	6033	27			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6055	45			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
1414	RLH	6070	56			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6121	81			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
14	RLH	6141	97			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6214	140			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
1414	RLH	6236	158			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6250	168			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6252	170			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
1414	RLH	6256	174			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6313	203			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
1414	RLH	6321	209			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
1414	RLH	6362	242			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
1414	RLH	6363	243			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI

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*   UNIVERSITIES   *
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USER ID	PROD REQ	PLATFORM OCT	DEC	LAT	LONG	LOC	STUDY	VALID	USER	AFFILIATION
1050	L	6060	48				HYDR	10-24-72	HENRY	ALA UNIV
1050	L	6061	49				HYDR	10-24-72	HENRY	ALA UNIV
1050	L	6105	69				HYDR	10-24-72	HENRY	ALA UNIV
1050	L	6120	80				HYDR	10-24-72	HENRY	ALA UNIV
1050	L	6156	110				HYDR	10-24-72	HENRY	ALA UNIV
50	L	6164	116				HYDR	10-24-72	HENRY	ALA UNIV
1050	L	6224	148				HYDR	10-24-72	HENRY	ALA UNIV
1050	L	6265	181				HYDR	10-24-72	HENRY	ALA UNIV

105D	L	6323	211				HYDR	10-24-72	HENRY	ALA UNIV
105D	L	6346	230				HYDR	10-24-72	HENRY	ALA UNIV
105D	L	6357	239				HYDR	10-24-72	HENRY	ALA UNIV
[illegible]3D	LH	6047	39			ARIZ		10-24-72	HENDRICKSON	ARIZ UNIV
[illegible]3D	LH	6167	119			ARIZ		10-24-72	HENDRICKSON	ARIZ UNIV
103D	LH	6351	241			ARIZ		10-24-72	HENDRICKSON	ARIZ UNIV
100D	LH	6007	7				HMET	9-22-72	HOFFER	COLORADO UNIV
100D	LH	6054	44				HMET	9-22-72	HOFFER	COLORADO UNIV
U661	LH	6131	89			KANS		10-24-72	KANEMASU	KSU-KANSAS
U661	LH	6310	200			KANS		10-24-72	KANEMASU	KSU-KANSAS

FOREIGN

USER ID	PROD REQ	PLATFORM OCT	DEC	LAT	LONG	LOC	STUDY	VALID	USER	AFFILIATION
F360	RLB	6102	66	51-38N	86-24W	ONT	HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6126	86	50-38N	117-03W	BC	HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6137	95				HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6150	104	59-23N	108-53W	SASK	HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6232	154				HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6260	176	61-52N	121-21W	NWT	HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6353	235				HMET	8-31-72	CAMPBELL	-ONTARIO
[illegible]0	RLB	6354	236	51-01N	118-05W	BC	HMET	8-31-72	CAMPBELL	-ONTARIO
F360	RLB	6366	246				HMET	8-31-72	CAMPBELL	-ONTARIO
F368	RL	6270	184	46-52N	71-39W	QUEB	HMET	8-31-72	PERRIER	RESOURCES-QUE
F461	RLB	6210	136				HMET	8-31-72	KRUUS	FISH-OTTAWA
F501	RL	6222	146				HMET	8-31-72	ZUBRYCKY	FISH-OTTAWA
F502	RLB	6135	93	43-17N	79-08W	ONT	HMET	8-31-72	MACPHAIL	IN WATER-ONT
F503	RL	6330	216				HMET	8-31-72	VOCKEROTH	ATMOS-ONT

PRIVATE

USER ID	PROD REQ	PLATFORM OCT	DEC	LAT	LONG	LOC	STUDY	VALID	USER	AFFILIATION
106D		7701	961	38-59N	76-51W	GSFC	TEST	7-23-72	SMITH	NASA-GSFC
106D	LB	7707	967	38-59N	76-51W	GSFC	TEST	7-23-72	SMITH	NASA-GSFC
F[illegible]50	LB	7000	512	40-05N	75-23W	PENN	TEST	7-23-72	WOOD	GE-VF
F[illegible]50		7001	513	40-05N	75-23W	PENN	TEST	7-23-72	WOOD	GE-VF

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*    STATE    *
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USER ID	PRØD REQ	PLATFØRM ØCT	DEC	LAT	LØNG	LØC	STUDY	VALID	USER	AFFILIATIØN
102D	L	6155	109			ØH10		10-24-72	SWEET	BATTELLE LABS

STØP 0

RUN

JMW
GSFC-430
4-02-73

ERTS DCS PLATFORMS
SORTED BY DCP ID

PLATFORM OCT	DEC	USER ID	PRO REQ	LAT	LONG	LOC	STUDY	VALID	USER	AFFILIATION
6000	0									
6001	1									
6002	2									
6003	3									
6004	4	I015	LH			MISS	HYDR	8-31-72	PREBLE	USGS-MISS
6005	5	I384	LH				GEOL	8-31-72	EATON	USGS-CALIF
6006	6	I066	LH	33-44N	112-37W	ARIZ	HYDR	8-31-72	SCHUMAN	USGS-PHOENIX
6007	7	I00D	LH				HMET	9-22-72	HOFFER	COLORADO UNIV
6010	8	D002	RLH	41-45N	71-27W	RI	HYDR	8-31-72	COOPER	ARMY ENG-MASS
6011	9	I384	LH				GEOL	9-22-72	EATON	USGS-CALIF
6012	10	D002	RLH				HYDR	11-27-72	COOPER	ARMY ENG MASS
6013	11	I015	LH			MISS	HYDR	12-15-72	PREBLE	USGS-MISS
6014	12	N024	RLH				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
6015	13									
6016	14	I066	LH				HYDR	7-23-72	SCHUMAN	USGS-PHOENIX
6017	15	I015	LH			MISS	HYDR	8-31-72	PREBLE	USGS-MISS
6020	16	I023	LH	40-30N	121-15W	CALF	GEOL	8-31-72	FRIEDMAN	USGS-WASH-DC
6021	17	D002	RLH	44-52N	69-51W	MAIN	HYDR	8-31-72	COOPER	ARMY ENG-MASS
22	18	N024	RLH				HYDR	8-31-72	KRIEGER	NASA-WALLOPS
6023	19	N024	RLH				HYDR	11-08-72	KRIEGER	NASA-WALLOPS
6024	20	I015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6025	21	I025	RL			COLO	MET	11-27-72	KAHAN	RECLAMATION
6026	22									
6027	23									
6030	24	I340	RLH	41-02N	75-01W	PENN	HYDR	7-23-72	PAULSON	USGS-HARISBG
6031	25	I414	RLH			FLA	HYDR	7-23-72	HIGER	USGS-MIAMI
6032	26	N024	RLH				HYDR	8-31-72	KRIEGER	NASA-WALLOPS
6033	27	I414	RLH			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
6034	28	I384	LH				GEOL	9-22-72	EATON	USGS-CALIF
6035	29	N024	RLH				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
6036	30	I384	LH				GEOL	10-24-72	EATON	USGS-CALIF
6037	31	I381	L				HYDR	10-24-72	BARNES	USGS-NASHVILE
6040	32	I025	RL			COLO	MET	11-27-72	KAHAN	RECLAMATION
6041	33									
6042	34	D002	RLH				HYDR	11-27-72	COOPER	ARMY ENG MASS
6043	35	I384	LH				GEOL	8-31-72	EATON	USGS-CALIF
6044	36	N347	L				HYDR	8-31-72	ERB	NASA-MSC
6045	37	N347	L				HYDR	8-31-72	ERB	NASA-MSC
6046	38	I340	RLH	39-33N	75-51W	NJ	HYDR	8-31-72	PAULSON	USGS-HARISBG
6047	39	I03D	LH			ARIZ		10-24-72	HENDRICKSON	ARIZ UNIV
6050	40	N024	RLH				HYDR	11-08-72	KRIEGER	NASA-WALLOPS
6051	41	I015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6052	42	N024	RLH				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
6053	43									
6054	44	I00D	LH				HMET	9-22-72	HOFFER	COLORADO UNIV
6055	45	I414	RLH			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI

6056	46	1023	LH				GEOL	9-22-72	FRIEDMAN	USGS-WASH-DC
6057	47	1384	LH				GEOL	8-31-72	EATON	USGS-CALIF
6060	48	105D	L				HYDR	10-24-72	HENRY	ALA UNIV
6061	49	105D	L				HYDR	10-24-72	HENRY	ALA UNIV
062	50	1025	RL			COLO	MET	11-27-72	KAHAN	RECLAMATION
063	51	1380	L	42-40N	70-54W	MASS		11-27-72	KNOX	USGS-BOSTON
6064	52									
6065	53									
6066	54	1384	LH				GEOL	7-23-72	EATON	USGS-CALIF
6067	55	1340	RLH	39-41N	75-41W	DEL	HYDR	8-31-72	PAULSON	USGS-HARISBG
6070	56	1414	RLH			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
6071	57	D002	RLH	45-14N	68-39W	MAIN	HYDR	8-31-72	COOPER	ARMY ENG-MASS
6072	58	N024	RLH				HYDR	8-31-72	KRIEGER	NASA-WALLOPS
6073	59	1340	RLH	40-58N	76-52W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
6074	60	D011	LH				HYDR	10-24-72	KEE	USN OCEANGRAPH
6075	61	N130	LO			CALF		11-27-72	LUM	NASA-AMES
6076	62									
6077	63	N347	L				HYDR	7-23-72	ERB	NASA-MSC
6100	64									
6101	65	D002	RLH	41-02N	73-32W	CONN	HYDR	7-23-72	COOPER	ARMY ENG-MASS
6102	66	F360	RLO	51-38N	86-24W	ONT	HMET	8-31-72	CAMPBELL	-ONTARIO
6103	67	1384	LH				GEOL	8-31-72	EATON	USGS-CALIF
6104	68	1023	LH	40-30N	121-20W	CALF	GEOL	8-31-72	FRIEDMAN	USGS-WASH-DC
6105	69	105D	L				HYDR	10-24-72	HENRY	ALA UNIV
6106	70	D002	RLH	43-48N	70-47W	NH	HYDR	11-07-72	COOPER	ARMY-ENG-MASS
6107	71	1015	LH			MISS	HYDR	8-31-72	PREBLE	USGS-MISS
6110	72	1015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6111	73									
6112	74	N347	L				HYDR	8-31-72	ERB	NASA-MSC
6113	75									
14	76	1340	RLH	39-30N	75-34W	DEL	HYDR	8-31-72	PAULSON	USGS-HARISBG
6115	77	1340	RLH	39-56N	75-11W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
6116	78	1340	RLH	41-18N	74-47W	NJ	HYDR	8-31-72	PAULSON	USGS-HARISBG
6117	79	1384	LH				GEOL	10-24-72	EATON	USGS-CALIF
6120	80	105D	L				HYDR	10-24-72	HENRY	ALA UNIV
6121	81	1414	RLH			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
6122	82	1015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6123	83									
6124	84	1340	RLH	39-34N	75-34W	DEL	HYDR	7-23-72	PAULSON	USGS-HARISBG
6125	85	N347	L				HYDR	7-23-72	ERB	NASA-MSC
6126	86	F360	RLO	50-38N	117-03W	BC	HMET	8-31-72	CAMPBELL	-ONTARIO
6127	87	D002	RLH	41-46N	72-40W	CONN	HYDR	8-31-72	COOPER	ARMY ENG-MASS
6130	88									
6131	89	U561	LH			KANS		10-24-72	KANEMASU	KSU-KANSAS
6132	90	1384	LH				GEOL	10-24-72	EATON	USGS-CALIF
6133	91	N024	RLH				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
6134	92									
6135	93	F502	RLO	43-17N	79-08W	ONT	HMET	8-31-72	MACPHAIL	IN WATER-ONT
6136	94	1015	LH			MISS	HYDR	8-31-72	PREBLE	USGS-MISS
6137	95	F360	RLO				HMET	8-31-72	CAMPBELL	-ONTARIO
6140	96	104D	LH	44-16N	103-47W	SDAK	AGFR	7-23-72	HELLER	USDA-CALIF
6141	97	1414	RLH			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
6142	98	D002	RLH	42-34N	71-47W	MASS	HYDR	11-07-72	COOPER	ARMY ENG-MASS
6143	99	1025	RL			COLO	MET	11-27-72	KAHAN	RECLAMATION
6144	100	1378	L				HYDR	11-08-72	CAMERON	USGS-LOUISANA
45	101									
6146	102									
6147	103	D002	RLH	42-24N	71-13W	MASS	HYDR	7-23-72	COOPER	ARMY ENG MASS

6150	104	F360	RLØ	59-23N	108-53W	SASK	HMET	8-31-72	CAMPBELL	-ØNTARIØ
6151	105	I066	LH				HYDR	8-31-72	SCHUMAN	USGS-PHØENIX
6152	106	N347	L				HYDR	8-31-72	ERB	NASA-MSC
6153	107	D011	LH				HYDR	10-24-72	KEE	USN ØCEANGRAPH
6154	108	I384	LH				GEØL	9-22-72	EATØN	USGS-CALIF
.55	109	102D	L			ØHIØ		10-24-72	SWEET	BATTELLE LABS
6156	110	105D	L				HYDR	10-24-72	HENRY	ALA UNIV
6157	111	I015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6160	112									
6161	113									
6162	114	I384	LH				GEØL	7-23-72	EATØN	USGS-CALIF
6163	115	I384	LH				GEØL	9-22-72	EATØN	USGS-CALIF
6164	116	105D	L				HYDR	10-24-72	HENRY	ALA UNIV
6165	117	I066	LH				HYDR	9-22-72	SCHUMAN	USGS-PHØENIX
6166	118	I023	LH				GEØL	9-22-72	FRIEDMAN	USGS-WASH-DC
6167	119	103D	LH			ARIZ		10-24-72	HENDRICKSØN	ARIZ UNIV
6170	120	D002	RLH	45-14N	68-39W	MAIN	HYDR	11-07-72	CØØPER	ARMY ENG MASS
6171	121	D002	RLH				HYDR	11-27-72	CØØPER	ARMY ENG 4ASS
6172	122									
6173	123									
6174	124									
6175	125	104D	LH	44-16N	103-47W	SDAK	AGFR	7-23-72	HELLER	USDA-CALIF
6176	126	I384	LH				GEØL	8-31-72	EATØN	USGS-CALIF
6177	127	I066	LH				HYDR	8-31-72	SCHUMAN	USGS-PHØENIX
6200	128									
6201	129	D002	RLH				HYDR	11-07-72	CØØPER	ARMY ENG-MASS
6202	13	I025	RL			CØLØ	MET	11-27-72	KAHAN	RECLAMATIØN
6203	131	I381	L				HYDR	10-24-72	BARNES	USGS-NASHVILE
6204	132	I015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6205	133									
06	134	D002	RLH	43-45W	71-41W	NH	HYDR	11-07-72	CØØPER	ARMY-ENG-MASS
207	135	D002	RLH	42-24N	71-13W	MASS	HYDR	7-23-72	CØØPER	ARMY ENG-MASS
6210	136	F461	RLØ				HMET	8-31-72	KRUUS	FISH-ØTTAWA
6211	137	N347	L				HYDR	8-31-72	ERB	NASA-MSC
6212	138	I025	RL			CØLØ	MET	11-27-72	KAHAN	RECLAMATIØN
6213	139	I384	LH				GEØL	8-31-72	EATØN	USGS-CALIF
6214	140	I414	RLH			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
6215	141	I340	RLH	39-42N	75-27W	NJ	HYDR	10-24-72	PAULSØN	USGS-HARISBG
6216	142	D002	RLH	43-43N	72-17W	NH	HYDR	11-27-72	CØØPER	ARMY ENG MASS
6217	143									
6220	144	D002	RLH	42-15N	71-00W	MASS	HYDR	7-23-72	CØØPER	ARMY ENG-MASS
6221	145	N024	RLH				HYDR	7-23-72	KRIEGER	NASA-WALLØPS
6222	146	F501	RL				HMET	8-31-72	ZUBRYCKY	FISH-ØTTAWA
6223	147	I340	RLH	41-00N	75-05W	NJ	HYDR	8-31-72	PAULSØN	USGS-HARISBG
6224	148	105D	L				HYDR	10-24-72	HENRY	ALA UNIV
6225	149	I066	LH	33-29N	109-46W	ARIZ	HYDR	9-22-72	SCHUMAN	USGS-PHØENIX
6226	150	N024	RLH				HYDR	12-15-72	KRIEGER	NASA-WALLØPS
6227	151	I340	RLH	40-36N	75-22W	PENN	HYDR	10-24-72	PAULSØN	USGS-HARISBG
6230	152	I015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6231	153									
6232	154	F360	RLØ				HMET	8-31-72	CAMPBELL	-ØNTARIØ
6233	155	D002	RLH				HYDR	11-07-72	CØØPER	ARMY ENG-MASS
6234	156	N347	L				HYDR	8-31-72	ERB	NASA-MSC
6235	157	N347	L				HYDR	8-31-72	ERB	NASA-MSC
6236	158	I414	RLH			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
237	159	I378	L				HYDR	11-08-72	CAMERØN	USGS-LØUISANA
40	160	I384	LH				GEØL	10-24-72	EATØN	USGS-CALIF
6241	161	I025	RL			CØLØ	MET	11-27-72	KAHAN	RECLAMATIØN

6242	162	D002	RLH	42-09N	72-35W	MASS	HYDR	11-27-72	COOPER	ARMY ENG MASS
6243	163									
6244	164	N347	L				HYDR	8-31-72	ERB	NASA-MSC
6245	165	I015	LH			MISS	HYDR	8-31-72	PREBLE	USGS-MISS
46	166	D002	RLH	42-15N	71-00W	MASS	HYDR	8-31-72	COOPER	ARMY ENG-MASS
47	167	I384	LH				GEOL	9-22-72	EATON	USGS-CALIF
6250	168	I414	RLH			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
6251	169	I023	LH				GEOL	8-31-72	FRIEDMAN	USGS-WASH-DC
6252	170	I414	RLH			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
6253	171									
6254	172	D002	RLH	42-47N	72-23W	NH	HYDR	11-27-72	COOPER	ARMY ENG MASS
6255	173									
6256	174	I414	RLH			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
6257	175	I015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6260	176	F360	RLU	61-52N	121-21W	NWT	HMET	8-31-72	CAMPBELL	-ONTARIO
6261	177	I066	LH	34-38N	111-51W	ARIZ	HYDR	8-31-72	SCHUMAN	USGS-PHOENIX
6262	178	I384	LH				GEOL	9-22-72	EATON	USGS-CALIF
6263	179	I015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6264	180	I382	L	45-23N	122-07W	OREG	HYDR	10-24-72	KAPUTSKA	USGS-OREGON
6265	181	I05D	L				HYDR	10-24-72	HENRY	ALA UNIV
6266	182	I015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6267	183									
6270	184	F368	RL	46-52N	71-39W	QUEB	HMET	8-31-72	PERRIER	RESOURCES-QUE
6271	185	D002	RLH	47-15N	68-35W	MAIN	HYDR	8-31-72	COOPER	ARMY ENG-MASS
6272	186	D002	RLH				HYDR	11-07-72	COOPER	ARMY ENG MASS
6273	187	D002	RLH				HYDR	11-07-72	COOPER	ARMY ENG-MASS
6274	188	I384	LH				GEOL	10-24-72	EATON	USGS-CALIF
6275	189	I340	RLH	40-04N	74-51W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
6276	190	I384	LH				GEOL	9-22-72	EATON	USGS-CALIF
6277	191	I340	RLH	40-13N	74-46W	NJ	HYDR	10-24-72	PAULSON	USGS-HARISBG
00	192									
6301	193	I015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6302	194									
6303	195	I015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6304	196	D002	RLH	44-04N	70-12W	MAIN	HYDR	11-27-72	COOPER	ARMY-ENG-MASS
6305	197	N024	RLH				HYDR	8-31-72	KRIEGER	NASA-WALLOPS
6306	198	I340	RLH	40-41N	75-12W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
6307	199	I340	RLH	40-15N	76-52W	PENN	HYDR	12-15-72	PAULSON	USGS-HARISBG
6310	200	U661	LH			KANS		10-24-72	KANEMASU	KSU-KANSAS
6311	201	I384	LH				GEOL	10-24-72	EATON	USGS-CALIF
6312	202	I340	RLH	40-42N	75-11W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
6313	203	I414	RLH			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
6314	204									
6315	205	I384	LH				GEOL	8-31-72	EATON	USGS-CALIF
6316	206									
6317	207	I04D	LH	44-16N	103-47W	SDAK	AGFR	7-23-72	HELLER	USDA-CALIF
6320	208	I384	LH				GEOL	8-31-72	EATON	USGS-CALIF
6321	209	I414	RLH			FLA	HYDR	8-31-72	HIGER	USGS-MIAMI
6322	210	I340	RLH	39-33N	75-27W	NJ	HYDR	10-24-72	PAULSON	USGS-HARISBG
6323	211	I05D	L				HYDR	10-24-72	HENRY	ALA UNIV
6324	212	N024	RLH				HYDR	11-08-72	KRIEGER	NASA-WALLOPS
6325	213	D002	RLH	43-43N	72-17W	NH	HYDR	11-27-72	COOPER	ARMY ENG MASS
6326	214									
6327	215	I015	LH			MISS	HYDR	8-31-72	PREBLE	USGS-MISS
6330	216	F503	RL				HMET	8-31-72	VOCKEROTH	ATMOS-ONT
31	217	I340	RLH	40-01N	74-59W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
6332	218	I340	RLH	39-50N	75-22W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
6333	219	N024	RLH				HYDR	11-08-72	KRIEGER	NASA-WALLOPS

6334	220	I384	LH				GEOL	9-22-72	EATON	USGS-CALIF
6335	221	D002	RLH				HYDR	11-07-72	COOPER	ARMY ENG-MASS
6336	222	D011	LH				HYDR	10-24-72	KEE	USN OCEANGRAPH
6337	223	I015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6340	224									
41	225	I340	RLH	39-58N	75-11W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
6342	226	I384	LH				GEOL	8-31-72	EATON	USGS-CALIF
6343	227	I340	RLH	40-13N	74-46W	NJ	HYDR	8-31-72	PAULSON	USGS-HARISBG
6344	228	I340	RLH	39-57N	75-08W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
6345	229	D002	RLH	42-59N	71-35W	NH	HYDR	11-27-72	COOPER	ARMY ENG MASS
6346	230	105D	L				HYDR	10-24-72	HENRY	ALA UNIV
6347	231	I025	RL			COLO	MET	11-27-72	KAHAN	RECLAMATION
6350	232	N024	RLH				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
6351	233	I015	LH			MISS	HYDR	11-27-72	PREBLE	USGS-MISS
6352	234									
6353	235	F360	RLO				HMET	8-31-72	CAMPBELL	-ONTARIO
6354	236	F360	RLO	51-01N	118-05W	BC	HMET	8-31-72	CAMPBELL	-ONTARIO
6355	237	D002	RLH	42-06N	72-38W	NY	HYDR	8-31-72	COOPER	ARMY ENG-MASS
6356	238	D002	RLH	42-15N	71-15W	MASS	HYDR	8-31-72	COOPER	ARMY ENG-MASS
6357	239	105D	L				HYDR	10-24-72	HENRY	ALA UNIV
6360	240	N024	RLH				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
6361	241	103D	LH			ARIZ		10-24-72	HENDRICKSON	ARIZ UNIV
6362	242	I414	RLH			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
6363	243	I414	RLH			FLA	HYDR	12-15-72	HIGER	USGS-MIAMI
6364	244									
6365	245	I384	LH				GEOL	8-31-72	EATON	USGS-CALIF
6366	246	F360	RLO				HMET	8-31-72	CAMPBELL	-ONTARIO
6367	247	I340	RLH	39-57N	75-08W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
6370	248	I384	LH				GEOL	8-31-72	EATON	USGS-CALIF
6371	249	I340	RLH	39-57N	75-08W	PENN	HYDR	8-31-72	PAULSON	USGS-HARISBG
72	250	I384	LH				GEOL	10-24-72	EATON	USGS-CALIF
73	251	I340	RLH	41-45N	76-26W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
6374	252									
6375	253	N024	RLH				HYDR	12-15-72	KRIEGER	NASA-WALLOPS
6376	254									
6377	255									
6400	256									
6401	257	N024	RLH				HYDR	7-23-72	KRIEGER	NASA-WALLOPS
6402	258	I340	RLH	40-28N	77-07W	PENN	HYDR	10-24-72	PAULSON	USGS-HARISBG
6403	259									
6404	260									
6405	261									
6406	262									
6407	263									
7000	512	P550	LO	40-05N	75-23W	PENN	TEST	7-23-72	WOOD	GE-VF
7001	513	P550		40-05N	75-23W	PENN	TEST	7-23-72	WOOD	GE-VF
7701	961	106D		38-59N	76-51W	GSFC	TEST	7-23-72	SMITH	NASA-GSFC
7707	967	106D	LO	38-59N	76-51W	GSFC	TEST	7-23-72	SMITH	NASA-GSFC

STOP 0

APPENDIX D

ERTS-1 FLIGHT HARDWARE OPERATING TIME SUMMARY

Table 1. ERTS-1 Flight Hardware Operating Time Summary as of 23 July 1972

Subsystem	Module	S/N*	Test Hours**
Command	Clock	FT-1	1895
	VHF Receiver	02	2536
	CIU	6549450	2523
VIP	Digit Mux	0004	2439
	Reprogrammer	0004	2439
	Analog Mux	0003	2504
	Memory Sequencer	0004	2557
	Memory A/B	0005/0007	2567
Power	S/C Regulator	007	2549
	P/L Regulator	008	2542
	Aux Load Cont	6549313	2526
	Aux Load Panel 2	6549311	297
	Aux Load Panel 1	6549288	297
	Battery 1	37	2418
	Battery 2	38	2818
	Battery 3	41	2407
	Battery 4	35	2405
	Battery 5	34	2419
	Battery 6	39	2385
	Battery 7	36	2418
	Battery 8	33	2418
	ISM	EAB-FT-1	2535
	PSM	6549500	2459
RBV	RBV Elect 1	007	230
	RBV Elect 2	005	221
	RBV Elect 3	006	217
	RBV Camera 1	007	230
	RBV Camera 2	005	221
	RBV Camera 3	006	217
	CCC	004	306
	Mag. MOM Comp	6549512	206
MSS	MSS Scanner System	1	270
	MSS Multiplexer	2	270
	MSS Scanner	1	270
WBVTR	WBVTR Elect 1	Proto	268
	WBVTR 1 (T/T)	Proto	268
	WBVTR 1 (R/P)	Proto	126
	WBVTR Elect 2	FT-3	88
	WBVTR 2 (T/T)	FT-3	90
	WBVTR 2 (R/P)	FT-3	45
OA	OA	FT-1	
	SOL 1		Firings - 54
	SOL 2		52
	SOL 3		50
APU	APU	6549503	1861
Narrowband Telemetry	Beacon Transmitter	0003	2250
	NBTR 2	EAB-FT-1	1437
	NBTR 1	EAB-FT-2	1370
	USBE	EAB-FT-2	177
	PMP	FT-1	2354
Thermal	TM Conv Mod 3	6549315	2365
	TM Conv Mod 1	5962964	2359
	TM Conv Mod 2	5962965	2358
Unfold	Unfold Timer	5962963	12
DCS	DCS A	FT-4	370
	DCS B	FT-5	256
WBTSS	WBPA 1	QM-1	468
	WBPA 2		474
	WBPS	6549509	597
	WBFM	6549506	586
	WB Output Filter 1	3	168
	WB Output Filter 2	6	178
ACS	Right SAD	FT-03	1800
	Left SAD	FT-02	1035
	Yaw Rate Gyro	FT-2	327
	RMP "A"	FT-02	725
	RMP "B"	FT-03	743
	Logic Box	FT-1	2500
	Scanner No. 1	FT-2	2500
	Scanner No. 2	FT-6	1344
	Timer	005	2315
	Pitch Flywheel	706 003	1773
	Yaw Flywheel	908 005	2315
MMCA	MMCA	FT-1	15
AMS	AMS	FT-1	1094

* Extracted from consolidated configured articles list, issued July 7, 1972.
**Extracted from quality assurance LOS books.

APPENDIX E

ERTS–1 ATTITUDE AND RATE HISTOGRAMS

MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : Helen Neumann

732:18:RVW:pap
DATE: 5 February 1973

FROM : Raymond V. Welch

SUBJECT: ERTS-1 Attitude and Rate Histograms

This memo presents the statistics, in graphical form, of the pitch and roll rates and attitudes for the ERTS-1 spacecraft. The frequency of occurrences of ERTS-1 attitude and rate levels, represented graphically by histograms were generated using telemetered AMS pitch and roll attitude data from orbits 2031 through 2042. Estimates of pitch and roll rates for each second of time were calculated as the difference between successive one-second attitude measurements. Due to the resolution of the telemetry data, these estimated rates were quantized to .0078 deg/sec; and except for sunrise-sunset or gating transients, these rates took on values of either ± .0078 deg/sec or zero. Therefore, in order to generate useful rate histograms, it was necessary to smooth the estimated rates. The smoothing technique employed was to compute the rate at any time, t, by averaging the estimated rates for the previous n seconds. This smoothing technique required the rate histograms to have class intervals of width given by any integer multiple of .0078/n deg/sec. In this study the rate histograms were investigated for two values of n, 10 and 20, and for a class interval of .0078/n deg/sec. The results of these two cases were basically the same and it was therefore assumed that the smoothing technique did not unduly color the data.

The rate histograms generated with n = 10 and class interval of width .00078 deg/sec are shown in Figure 1. Figure 2 shows the attitude histograms for a class interval of width .039 deg. These histograms contain 80600 data points. The secondary peaks occurring in the attitude histograms beyond ± .78 degrees are caused by sunrise-sunset transients. The effects of these transients on the rate histograms are not noticeable for the scale used to plot these histograms.

Raymond V. Welch

Raymond V. Welch

CC
B. G. Zimmerman
H. L. Stallings

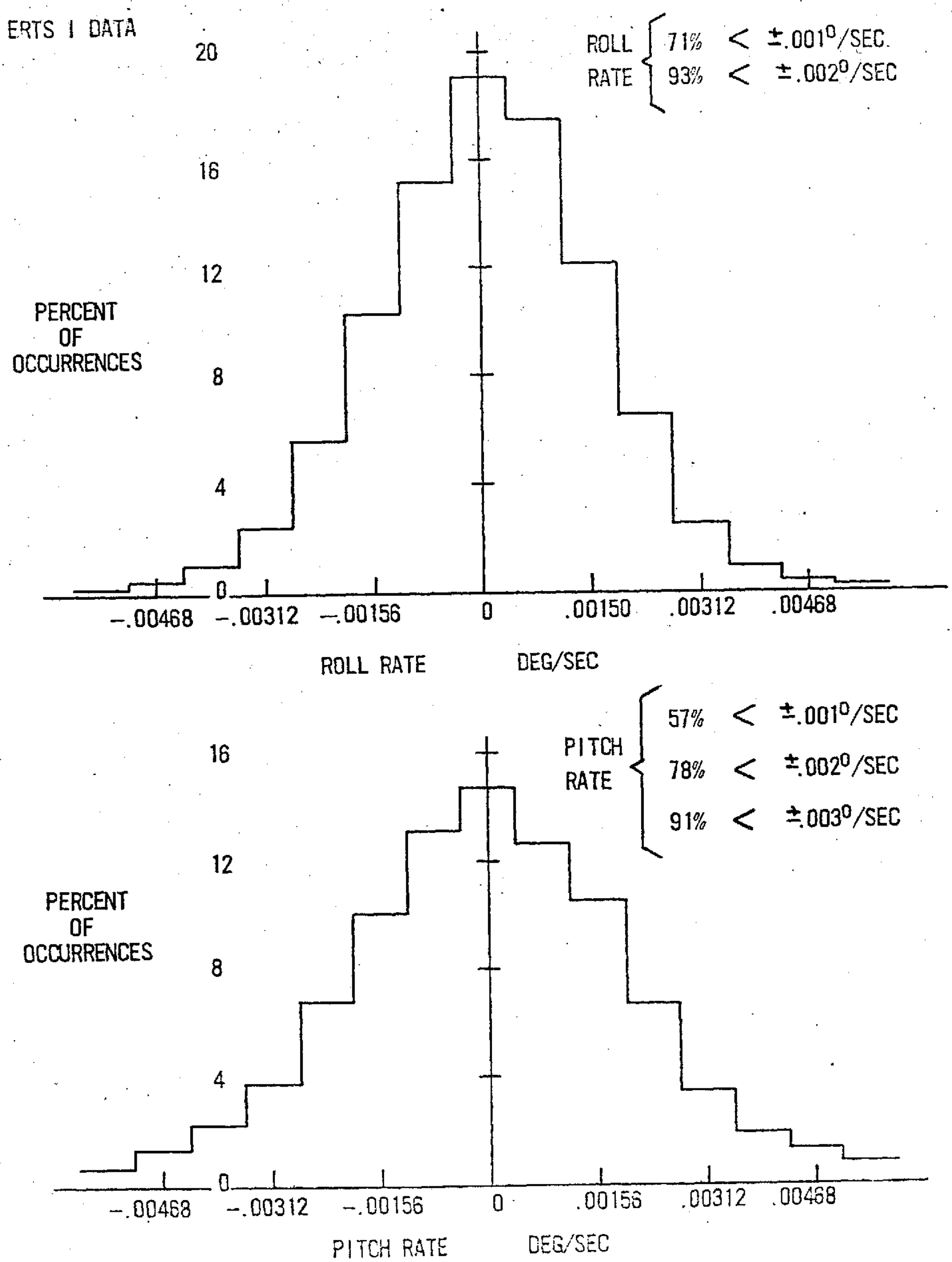

FIGURE 1 RATE HISTOGRAMS

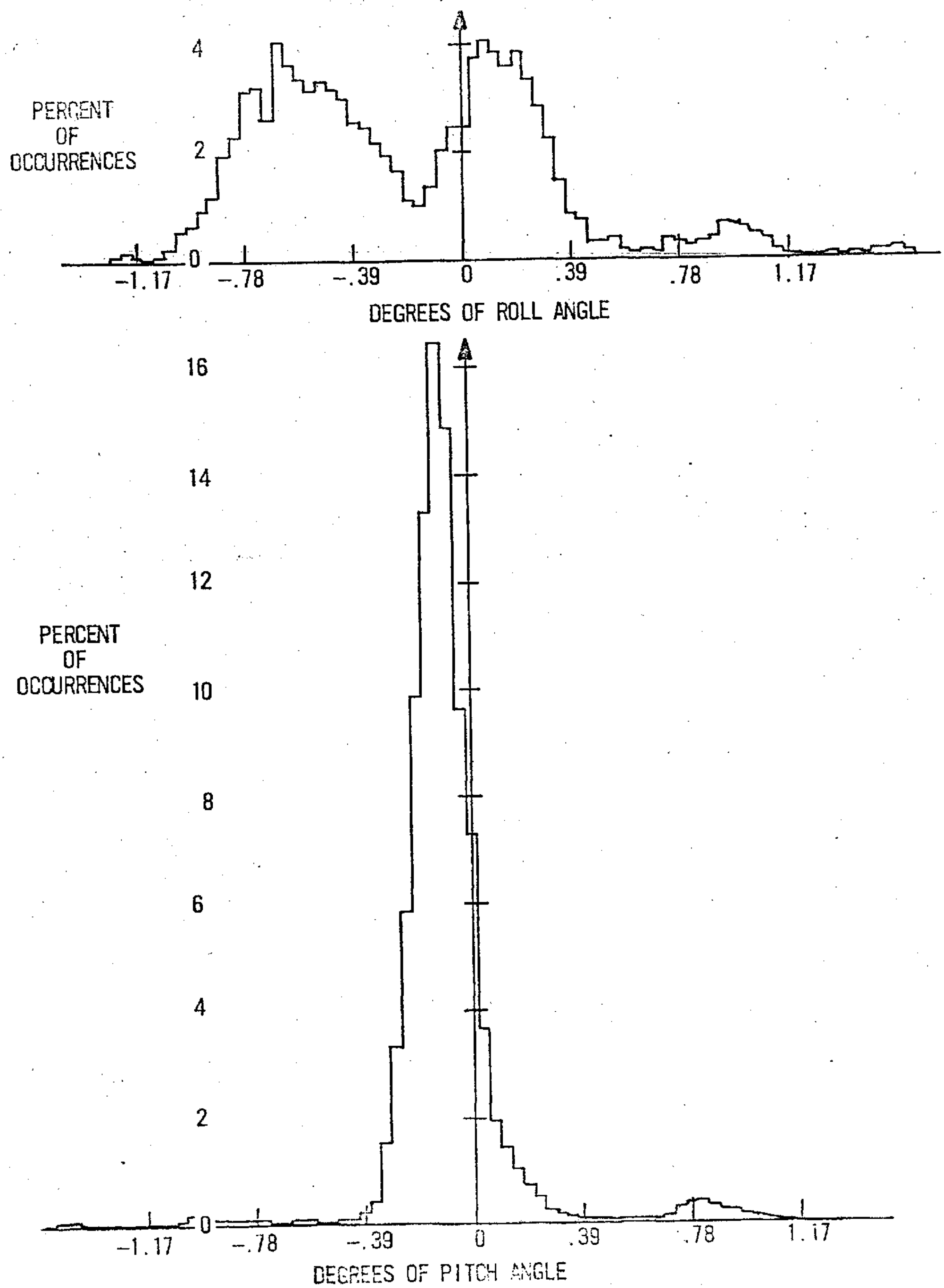

FIGURE 2 ATTITUDE HISTOGRAMS

APPENDIX F

ERTS-1 GROUND TRACE REPEAT CYCLE PREDICTIONS TABLE

JULY 1972

Date	GMT Day	Flight Day	Spacecraft Orbit	Reference Orbit	Ref Day	Cycle
23	205	0	0-3	150-153	11	
24	206	1	4-17	154-167	12	
25	207	2	18-31	168-181	13	
26	208	3	32-45	168-181*	13	
27	209	4	46-59	182-195	14	0th
28	210	5	60-73	196-209	15	
29	211	6	74-87	210-223	16	
30	212	7	88-101	224-237	17	
31	213	8	102-115	238-251	18	

*Shift due to initial orbit (prior to orbit adjustments)

AUGUST 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	214	9	116-129	1-14	1	
2	215	10	130-143	15-28	2	
3	216	11	144-157	29-42	3	
4	217	12	158-171	43-56	4	
5	218	13	172-185	57-70	5	
6	219	14	186-199	71-84	6	
7	220	15	200-213	85-98	7	
8	221	16	214-226	99-111	8	
9	222	17	227-240	112-125	9	1st
10	223	18	241-254	126-139	10	
11	224	19	255-268	140-153	11	
12	225	20	269-282	154-167	12	
13	226	21	283-296	168-181	13	
14	227	22	297-310	182-195	14	
15	228	23	311-324	196-209	15	
16	229	24	325-338	210-223	16	
17	230	25	339-352	224-237	17	
18	231	26	353-366	238-251	18	
19	232	27	367-380	1-14	1	
20	233	28	381-394	15-28	2	
21	234	29	395-408	29-42	3	
22	235	30	409-422	43-56	4	
23	236	31	423-436	57-70	5	
24	237	32	437-450	71-84	6	
25	238	33	451-464	85-98	7	
26	239	34	465-478	99-111	8	
27	240	35	479-491	112-125	9	
28	241	36	492-505	126-139	10	
29	242	37	506-519	140-153	11	
30	243	38	520-533	154-167	12	
31	244	39	534-547	168-181	13	2nd

SEPTEMBER 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	245	40	548-561	182-195	14	2nd
2	246	41	562-575	196-209	15	
3	247	42	576-589	210-223	16	
4	248	43	590-603	224-237	17	
5	249	44	604-617	238-251	18	
6	250	45	618-631	1-14	1	
7	251	46	632-645	15-28	2	
8	252	47	646-659	29-42	3	
9	253	48	660-673	43-56	4	
10	254	49	674-687	57-70	5	
11	255	50	688-701	71-84	6	
12	256	51	702-715	85-98	7	
13	257	52	716-728	99-111	8	
14	258	53	729-742	112-125	9	
15	259	54	743-756	126-139	10	3rd
16	260	55	757-770	140-153	11	
17	261	56	771-784	154-167	12	
18	262	57	785-798	168-181	13	
19	263	58	799-812	182-195	14	
20	264	59	813-826	196-209	15	
21	265	60	827-840	210-223	16	
22	266	61	841-854	224-237	17	
23	267	62	855-868	238-251	18	
24	268	63	869-882	1-14	1	
25	269	64	883-896	15-28	2	
26	270	65	897-910	29-42	3	
27	271	66	911-924	43-56	4	
28	272	67	925-938	57-70	5	
29	273	68	939-952	71-84	6	
30	274	69	953-966	85-98	7	4th

OCTOBER 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	275	70	967-979	99-111	8	4th
2	276	71	980-993	112-125	9	
3	277	72	994-1007	126-139	10	
4	278	73	1008-1021	140-153	11	
5	279	74	1022-1035	154-167	12	
6	280	75	1036-1049	168-181	13	
7	281	76	1050-1063	182-195	14	
8	282	77	1064-1077	196-209	15	
9	283	78	1078-1091	210-223	16	
10	284	79	1092-1105	224-237	17	
11	285	80	1106-1119	238-251	18	
12	286	81	1120-1133	1-14	1	
13	287	82	1134-1147	15-28	2	
14	288	83	1148-1161	29-42	3	
15	289	84	1162-1175	43-56	4	
16	290	85	1176-1189	57-70	5	
17	291	86	1190-1203	71-84	6	
18	292	87	1204-1217	85-98	7	
19	293	88	1218-1230	99-111	8	
20	294	89	1231-1244	112-125	9	
21	295	90	1245-1258	126-139	10	5th
22	296	91	1259-1272	140-153	11	
23	297	92	1273-1286	154-167	12	
24	298	93	1287-1300	168-181	13	
25	299	94	1301-1314	182-195	14	
26	300	95	1315-1328	196-209	15	
27	301	96	1329-1342	210-223	16	
28	302	97	1343-1356	224-237	17	
29	303	98	1357-1370	238-251	18	
30	304	99	1371-1384	1-14	1	
31	305	100	1385-1393	15-28	2	6th

NOVEMBER 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	306	101	1399-1412	29-42	3	6th
2	307	102	1413-1426	43-56	4	
3	308	103	1427-1440	57-70	5	
4	309	104	1441-1454	71-84	6	
5	310	105	1455-1468	85-98	7	
6	311	106	1469-1481	99-111	8	
7	312	107	1482-1495	112-125	9	
8	313	108	1496-1509	126-139	10	
9	314	109	1510-1523	140-153	11	
10	315	110	1524-1537	154-167	12	
11	316	111	1538-1551	168-181	13	
12	317	112	1552-1565	182-195	14	
13	318	113	1566-1579	196-209	15	
14	319	114	1580-1593	210-223	16	
15	320	115	1594-1607	224-237	17	
16	321	116	1608-1621	238-251	18	
17	322	117	1622-1635	1-14	1	
18	323	118	1636-1649	15-28	2	
19	324	119	1650-1663	29-42	3	
20	325	120	1664-1677	43-56	4	
21	326	121	1678-1691	57-70	5	
22	327	122	1692-1705	71-84	6	
23	328	123	1706-1719	85-98	7	
24	329	124	1720-1732	99-111	8	
25	330	125	1733-1746	112-125	9	
26	331	126	1747-1760	126-139	10	
27	332	127	1761-1774	140-153	11	
28	333	128	1775-1788	154-167	12	
29	334	129	1789-1802	168-181	13	
30	335	130	1803-1816	182-195	14	7th

DECEMBER 1972

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	336	131	1817-1830	196-209	15	7th
2	337	132	1831-1844	210-223	16	
3	338	133	1845-1858	224-237	17	
4	339	134	1859-1872	238-251	18	
5	340	135	1873-1886	1-14	1	
6	341	136	1887-1900	15-28	2	
7	342	137	1901-1914	29-42	3	
8	343	138	1915-1928	43-56	4	
9	344	139	1929-1942	57-70	5	
10	345	140	1943-1956	71-84	6	
11	346	141	1957-1970	85-98	7	
12	347	142	1971-1983	99-111	8	
13	348	143	1984-1997	112-125	9	
14	349	144	1998-2011	126-139	10	
15	350	145	2012-2025	140-153	11	8th
16	351	146	2026-2039	154-167	12	
17	352	147	2040-2053	168-181	13	
18	353	148	2054-2067	182-195	14	
19	354	149	2068-2081	196-209	15	
20	355	150	2082-2095	210-223	16	
21	356	151	2096-2109	224-237	17	
22	357	152	2110-2123	238-251	18	
23	358	153	2124-2137	1-14	1	
24	359	154	2138-2151	15-28	2	
25	360	155	2152-2165	29-42	3	
26	361	156	2166-2179	43-56	4	
27	362	157	2180-2193	57-70	5	
28	363	158	2194-2207	71-84	6	
29	364	159	2208-2221	85-98	7	
30	365	160	2222-2234	99-111	8	
31	366	161	2235-2248	112-125	9	9th

JANUARY 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	1	162	2249-2262	126-139	10	9th
2	2	163	2263-2276	140-153	11	
3	3	164	2277-2290	154-167	12	
4	4	165	2291-2304	168-181	13	
5	5	166	2305-2318	182-195	14	
6	6	167	2319-2332	196-209	15	
7	7	168	2333-2346	210-223	16	
8	8	169	2347-2360	224-237	17	
9	9	170	2361-2374	238-251	18	
10	10	171	2375-2388	1-14	1	
11	11	172	2389-2402	15-28	2	
12	12	173	2403-2416	29-42	3	
13	13	174	2417-2430	43-56	4	
14	14	175	2431-2444	57-70	5	
15	15	176	2445-2458	71-84	6	
16	16	177	2459-2472	85-98	7	
17	17	178	2473-2485	99-111	8	
18	18	179	2486-2499	112-125	9	
19	19	180	2500-2513	126-139	10	
20	20	181	2514-2527	140-153	11	10th
21	21	182	2528-2541	154-167	12	
22	22	183	2542-2555	168-181	13	
23	23	184	2556-2569	182-195	14	
24	24	185	2570-2583	196-209	15	
25	25	186	2584-2597	210-223	16	
26	26	187	2598-2611	224-237	17	
27	27	188	2612-2625	238-251	18	
28	28	189	2626-2639	1-14	1	
29	29	190	2640-2653	15-28	2	
30	30	191	2654-2667	29-42	3	
31	31	192	2668-2681	43-56	4	11th

FEBRUARY 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	32	193	2682-2695	57-70	5	11th
2	33	194	2696-2709	71-84	6	
3	34	195	271-2723	85-98	7	
4	35	196	2724-2736	99-111	8	
5	36	197	2737-2750	112-125	9	
6	37	198	2751-2764	126-139	10	
7	38	199	2765-2778	140-153	11	
8	39	200	2779-2792	154-167	12	
9	40	201	2793-2806	168-181	13	
10	41	202	2807-2820	182-195	14	
11	42	203	2821-2834	196-209	15	
12	43	204	2835-2848	210-223	16	
13	44	205	2849-2862	224-237	17	
14	45	206	2863-2876	238-251	18	
15	46	207	2877-2890	1-14	1	
16	47	208	2891-2904	15-28	2	
17	48	209	2905-2918	29-42	3	
18	49	210	2919-2932	43-56	4	
19	50	211	2933-2946	57-70	5	
20	51	212	2947-2960	71-84	6	
21	52	213	2961-2974	85-98	7	
22	53	214	2975-2987	99-111	8	
23	54	215	2988-3001	112-125	9	
24	55	216	3002-3015	126-139	10	
25	56	217	3016-3029	140-153	11	
26	57	218	3030-3043	154-167	12	
27	58	219	3044-3057	168-181	13	
28	59	220	3058-3071	182-195	14	12th

MARCH 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	60	221	3072-3085	196-209	15	12th
2	61	222	3086-3099	210-223	16	
3	62	223	3100-3113	224-237	17	
4	63	224	3114-3127	238-251	18	
5	64	225	3128-3141	1-14	1	
6	65	226	3142-3155	15-28	2	
7	66	227	3156-3169	29-42	3	
8	67	228	3170-3183	43-56	4	
9	68	229	3184-3197	57-70	5	
10	69	230	3198-3211	71-84	6	
11	70	231	3212-3225	85-98	7	
12	71	232	3226-3238	99-111	8	
13	72	233	3239-3252	112-125	9	
14	73	234	3253-3266	126-139	10	13th
15	74	235	3267-3280	140-153	11	
16	75	236	3281-3294	154-167	12	
17	76	237	3295-3308	168-181	13	
18	77	238	3309-3322	182-195	14	
19	78	239	3323-3336	196-209	15	
20	79	240	3337-3350	210-223	16	
21	80	241	3351-3364	224-237	17	
22	81	242	3365-3378	238-251	18	
23	82	243	3379-3392	1-14	1	
24	83	244	3393-3406	15-28	2	
25	84	245	3407-3420	29-42	3	
26	85	246	3421-3434	43-56	4	
27	86	247	3435-3448	57-70	5	
28	87	248	3449-3462	71-84	6	
29	88	249	3463-3476	85-98	7	
30	89	250	3477-3489	99-111	8	
31	90	251	3490-3503	112-125	9	14th

APRIL 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	91	252	3504-3517	126-139	10	14th
2	92	253	3518-3531	140-153	11	
3	93	254	3532-3545	154-167	12	
4	94	255	3546-3559	168-181	13	
5	95	256	3560-3573	182-195	14	
6	96	257	3574-3587	196-209	15	
7	97	258	3588-3601	210-223	16	
8	98	259	3602-3615	224-237	17	
9	99	260	3616-3629	238-251	18	
10	100	261	3630-3643	1-14	1	
11	101	262	3644-3657	15-28	2	
12	102	263	3658-3671	29-42	3	
13	103	264	3672-3685	43-56	4	
14	104	265	3686-3699	57-70	5	
15	105	266	3700-3713	71-84	6	
16	106	267	3714-3727	85-98	7	
17	107	268	3728-3740	99-111	8	
18	108	269	3741-3754	112-125	9	
19	109	270	3755-3768	126-139	10	15th
20	110	271	3769-3782	140-153	11	
21	111	272	3783-3796	154-167	12	
22	112	273	3797-3810	168-181	13	
23	113	274	3811-3824	182-195	14	
24	114	275	3825-3838	196-209	15	
25	115	276	3839-3852	210-223	16	
26	116	277	3853-3866	224-237	17	
27	117	278	3867-3880	238-251	18	
28	118	279	3881-3894	1-14	1	
29	119	280	3895-3908	15-28	2	
30	120	281	3909-3922	29-42	3	16th

MAY 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	121	282	3923-3936	43-56	4	16th
2	122	283	3937-3950	57-70	5	
3	123	284	3951-3964	71-84	6	
4	124	285	3965-3978	85-98	7	
5	125	286	3979-3991	99-111	8	
6	126	287	3992-4005	112-125	9	
7	127	288	4006-4019	126-139	10	
8	128	289	4020-4033	140-153	11	
9	129	290	4034-4047	154-167	12	
10	130	291	4048-4061	168-181	13	
11	131	292	4062-4075	182-195	14	
12	132	293	4076-4089	196-209	15	
13	133	294	4090-4103	210-223	16	
14	134	295	4104-4117	224-237	17	
15	135	296	4118-4131	238-251	18	
16	136	297	4132-4145	1-14	1	
17	137	298	4146-4159	15-28	2	
18	138	299	4160-4173	29-42	3	
19	139	300	4174-4187	43-56	4	
20	140	301	4188-4201	57-70	5	
21	141	302	4202-4215	71-84	6	
22	142	303	4216-4229	85-98	7	
23	143	304	4230-4242	99-111	8	
24	144	305	4243-4256	112-125	9	
25	145	306	4257-4270	126-139	10	
26	146	307	4271-4284	140-153	11	
27	147	308	4285-4298	154-167	12	
28	148	309	4299-4312	168-181	13	
29	149	310	4313-4326	182-195	14	
30	150	311	4327-4340	196-209	15	
31	151	312	4341-4354	210-223	16	17th

JUNE 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE
1	152	313	4355-4368	224-237	17	17th
2	153	314	4369-4382	238-251	18	
3	154	315	4383-4396	1-14	1	
4	155	316	4397-4410	15-28	2	
5	156	317	4411-4424	29-42	3	
6	157	318	4425-4438	43-56	4	
7	158	319	4439-4452	57-70	5	
8	159	320	4453-4466	71-84	6	
9	160	321	4467-4480	85-98	7	
10	161	322	4481-4493	99-111	8	
11	162	323	4494-4507	112-125	9	18th
12	163	324	4508-4521	126-139	10	
13	164	325	4522-4535	140-153	11	
14	165	326	4536-4549	154-167	12	
15	166	327	4550-4563	168-181	13	
16	167	328	4564-4577	182-195	14	
17	168	329	4578-4591	196-209	15	
18	169	330	4592-4605	210-223	16	
19	170	331	4606-4619	224-237	17	
20	171	332	4620-4633	238-251	18	
21	172	333	4634-4647	1-14	1	
22	173	334	4648-4661	15-28	2	
23	174	335	4662-4675	29-42	3	
24	175	336	4676-4689	43-56	4	
25	176	337	4690-4703	57-70	5	
26	177	338	4704-4717	71-84	6	
27	178	339	4718-4731	85-98	7	
28	179	340	4732-4744	99-111	8	
29	180	341	4745-4758	112-125	9	
30	181	342	4759-4772	126-139	10	19th

JULY 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	182	343	4773-4786	140-153	11	19th
2	183	344	4787-4800	154-167	12	
3	184	345	4801-4814	168-181	13	
4	185	346	4815-4828	182-195	14	
5	186	347	4829-4842	196-209	15	
6	187	348	4843-4856	210-223	16	
7	188	349	4857-4870	224-237	17	
8	189	350	4871-4884	238-251	18	
9	190	351	4885-4898	1-14	1	20th
10	191	352	4899-4912	15-28	2	
11	192	353	4913-4926	29-42	3	
12	193	354	4927-4940	43-56	4	
13	194	355	4941-4954	57-70	5	
14	195	356	4955-4968	71-84	6	
15	196	357	4969-4982	85-98	7	
16	197	358	4983-4995	99-111	8	
17	198	359	4996-5009	112-125	9	
18	199	360	5010-5023	126-139	10	
19	200	361	5024-5037	140-153	11	
20	201	362	5038-5051	154-167	12	
21	202	363	5052-5065	168-181	13	
22	203	364	5066-5079	182-195	14	
23	204	365	5080-5093	196-209	15	
24	205	366	5094-5107	210-223	16	
25	206	367	5108-5121	224-237	17	
26	207	368	5122-5135	238-251	18	
27	208	369	5136-5149	1-14	1	21st
28	209	370	5150-5163	15-28	2	
29	210	371	5164-5177	29-42	3	
30	211	372	5178-5191	43-56	4	
31	212	373	5192-5205	57-70	5	

AUGUST 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	213	374	5206-5219	71-84	6	21st
2	214	375	5220-5233	85-98	7	
3	215	376	5234-5246	99-111	8	
4	216	377	5247-5260	112-125	9	
5	217	378	5261-5274	126-139	10	
6	218	379	5275-5288	140-153	11	
7	219	380	5289-5302	154-167	12	
8	220	381	5303-5316	168-181	13	
9	221	382	5317-5330	182-195	14	
10	222	383	5331-5344	196-209	15	
11	223	384	5345-5358	210-223	16	
12	224	385	5359-5372	224-237	17	
13	225	386	5573-5386	238-251	18	
14	226	387	5387-5400	1-14	1	22nd
15	227	388	5401-5414	15-28	2	
16	228	389	5415-5428	29-42	3	
17	229	390	5429-5442	43-56	4	
18	230	391	5443-5456	57-70	5	
19	231	392	5457-5470	71-84	6	
20	232	393	5471-5484	85-98	7	
21	233	394	5485-5497	99-111	8	
22	234	395	5498-5511	112-125	9	
23	235	396	5512-5525	126-139	10	
24	236	397	5526-5539	140-153	11	
25	237	398	5540-5553	154-167	12	
26	238	399	5554-5567	168-181	13	
27	239	400	5568-5581	182-195	14	
28	240	401	5582-5595	196-209	15	
29	241	402	5696-5609	210-223	16	
30	242	403	5610-5623	224-237	17	
31	243	404	5624-5637	238-251	18	

SEPTEMBER 1973

DAY	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	244	405	5638-5651	1-14	1	23rd
2	245	406	5652-5665	15-28	2	
3	246	407	5666-5679	29-42	3	
4	247	408	5680-5693	43-56	4	
5	248	409	5694-5707	57-70	5	
6	249	410	5708-5721	71-84	6	
7	250	411	5722-5735	85-98	7	
8	251	412	5736-5748	99-111	8	
9	252	413	5749-5762	112-125	9	
10	253	414	5763-5776	126-139	10	
11	254	415	5777-5790	140-153	11	
12	255	416	5791-5804	154-167	12	
13	256	417	5805-5818	168-181	13	
14	257	418	5819-5832	182-195	14	
15	258	419	5833-5846	196-209	15	
16	259	420	5847-5860	210-223	16	
17	260	421	5861-5874	224-237	17	
18	261	422	5875-5888	238-251	18	
19	262	423	5889-5902	1-14	1	24th
20	263	424	5903-5916	15-28	2	
21	264	425	5917-5930	29-42	3	
22	265	426	5931-5944	43-56	4	
23	266	427	5945-5958	57-70	5	
24	267	428	5959-5972	71-84	6	
25	268	429	5973-5986	85-98	7	
26	269	430	5987-5999	99-111	8	
27	270	431	6000-6013	112-125	9	
28	271	432	6014-6027	126-139	10	
29	272	433	6028-6041	140-153	11	
30	273	434	6042-6055	154-167	12	

OCTOBER 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	274	435	6056-6069	168-181	13	24th
2	275	436	6070-6083	182-195	14	
3	276	437	6084-6097	196-209	15	
4	277	438	6098-6111	210-223	16	
5	278	439	6112-6125	224-237	17	
6	279	440	6126-6139	238-251	18	
7	280	441	6140-6153	1-14	1	
8	281	442	6154-6167	15-28	2	
9	282	443	6168-6181	29-42	3	
10	283	444	6182-6195	43-56	4	
11	284	445	6196-6209	57-70	5	
12	285	446	6210-6223	71-84	6	
13	286	447	6224-6237	85-98	7	
14	287	448	6238-6250	99-111	8	
15	288	449	6251-6264	112-125	9	25th
16	289	450	6265-6278	126-139	10	
17	290	451	6279-6292	140-153	11	
18	291	452	6293-6306	154-167	12	
19	292	453	6307-6320	168-181	13	
20	293	454	6321-6334	182-195	14	
21	294	455	6335-6348	196-209	15	
22	295	456	6349-6362	210-223	16	
23	296	457	6363-6376	224-237	17	
24	297	458	6377-6390	238-251	18	
25	298	459	6391-6404	1-14	1	26th
26	299	460	6405-6418	15-28	2	
27	300	461	6419-6432	29-42	3	
28	301	462	6433-6446	43-56	4	
29	302	463	6447-6460	57-70	5	
30	303	464	6461-6474	71-84	6	
31	304	465	6475-6488	85-98	7	

NOVEMBER 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	305	466	6489-6501	99-111	8	26th
2	306	467	6502-6515	112-125	9	
3	307	468	6516-6529	126-139	10	
4	308	469	6530-6543	140-153	11	
5	309	470	6544-6557	154-167	12	
6	310	471	6558-6571	168-181	13	
7	311	472	6572-6585	182-195	14	
8	312	473	6586-6599	196-209	15	
9	313	474	6000-6613	210-223	16	
10	314	475	6614-6627	224-237	17	
11	315	476	6628-6641	238-251	18	
12	316	477	6642-6655	1-14	1	27th
13	317	478	6656-6669	15-28	2	
14	318	479	6670-6683	29-42	3	
15	319	480	6684-6697	43-56	4	
16	320	481	6698-6711	57-70	5	
17	321	482	6712-6725	71-84	6	
18	322	483	6726-6739	85-98	7	
19	323	484	6740-6752	99-111	8	
20	324	485	6753-6766	112-125	9	
21	325	486	6767-6780	126-139	10	
22	326	487	6781-6794	140-153	11	
23	327	488	6795-6808	154-167	12	
24	328	489	6809-6822	168-181	13	
25	329	490	6823-6836	182-195	14	
26	330	491	6837-6850	196-209	15	
27	331	492	6851-6864	210-223	16	
28	332	493	6865-6878	224-237	17	
29	333	494	6879-6892	238-251	18	
30	334	495	6893-6906	1-14	1	28th

DECEMBER 1973

DATE	GMT DAY	FLIGHT DAY	SPACECRAFT ORBITS	REFERENCE ORBITS	REF DAY	CYCLE NO.
1	335	496	6907-6920	15-28	2	28th
2	336	497	6921-6934	29-42	3	
3	337	498	6935-6948	43-56	4	
4	338	499	6949-6962	57-70	5	
5	339	500	6963-6976	71-84	6	
6	340	501	6977-6990	85-98	7	
7	341	502	6991-7003	99-111	8	
8	342	503	7004-7017	112-125	9	
9	343	504	7018-7031	126-139	10	
10	344	505	7032-7045	140-153	11	
11	345	506	7046-7059	154-167	12	
12	346	507	7060-7073	168-181	13	
13	347	508	7074-7087	182-195	14	
14	348	509	7088-7101	196-209	15	
15	349	510	7102-7115	210-223	16	
16	350	511	7116-7129	224-237	17	
17	351	512	7130-7143	238-251	18	
18	352	513	7144-7157	1-14	1	29th
19	353	514	7158-7171	15-28	2	
20	354	515	7172-7185	29-42	3	
21	355	516	7186-7199	43-56	4	
22	356	517	7200-7213	57-70	5	
23	357	518	7214-7227	71-84	6	
24	358	519	7228-7241	85-98	7	
25	359	520	7242-7254	99-111	8	
26	360	521	7255-7268	112-125	9	
27	361	522	7269-7282	126-139	10	
28	362	523	7283-7296	140-153	11	
29	363	524	7297-7310	154-167	12	
30	364	525	7311-7324	168-181	13	
31	365	526	7325-7338	182-195	14	